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THE DATES OF ISSUE OF THE ANNUAL VOLUMES;
A GENERAL SUMMARY, SHOWING THE NUMBER OF THE PAGES, PLATES, FIGURES, AND SPECIES IN EACH MONOGRAPH;
AND A STRATIGRAPHICAL LIST OF THE BRITISH FOSSILS FIGURED AND DESCRIBED IN THE YEARLY VOLUMES.

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„ XVII.	„ 1863	The Trilobites of the Silurian, Devonian, &c., Formations, Part II, by Mr. J. W Salter, 8 plates. The Fossil Brachiopoda, Part VI, No. 2, Devonian, by Mr. Davidson, 11 plates. The Belemnitidæ, Part I, Introduction, by Prof. Phillips. The Reptilia of the Liassic Formations, Part I, by Prof. Owen, 16 plates.
„ XVIII.	„ 1864	The Fossil Echinodermata, Vol. II, Part II (Liassic Ophiuroidea), by Dr. Wright, 6 plates. The Trilobites of the Silurian, Devonian, &c., Formations, Part III, by Mr. J. W. Salter, 11 plates. The Belemnitidæ, Part II, Liassic Belemnites, by Prof. Phillips, 7 plates. The Pleistocene Mammalia, Part I, Introduction, Felis spelæa, by Messrs. W. Boyd Dawkins and W. A. Sanford, 5 plates. Title-pages, &c., to the Monographs on the Reptilia of the London Clay, Cretaceous, and Wealden Formations.
„ XIX.*	„ 1865	The Crag Foraminifera, Part I, No. 1, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady, 4 plates. Supplement to the Fossil Corals, Part I, Tertiary, by Dr. Duncan, 10 plates. The Fossil Merostomata, Part I, Pterygotus, by Mr. H. Woodward, 9 plates. The Fossil Brachiopoda, Part VII, No. 1, Silurian, by Mr. Davidson, 12 plates.
„ XX.*	„ 1866	Supplement to the Fossil Corals, Part IV, No. 1, Liassic, by Dr. Duncan, 11 plates. The Trilobites of the Silurian, Devonian, &c., Formations, Part IV (Silurian), by Mr. J. W. Salter, 6 plates. The Fossil Brachiopoda, Part VII, No. 2, Silurian, by Mr. Davidson, 10 plates. The Belemnitidæ, Part III, Liassic Belemnites, by Prof. Phillips, 13 plates.
„ XXI.*	„ 1867	Flora of Carboniferous Strata, Part I, by Mr. E. W. Binney, 6 plates. Supplement to the Fossil Corals, Part IV, No. 2, Liassic, by Dr. Duncan, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part II, by Dr. Wright, 14 plates. The Fishes of the Old Red Sandstone, Part I, by Messrs. J. Powrie and E. Ray Lankester, 5 plates. The Pleistocene Mammalia, Part II, Felis spelæa, continued, by Messrs. W. Boyd Dawkins and W. A. Sanford, 14 plates.

* These Volumes are issued in two forms of binding, first, with all the Monographs stitched together and enclosed in one cover; secondly, with each of the Monographs separate, and the whole of the separate parts placed in an envelope. The previous volumes are not in separate parts.

CATALOGUE OF WORKS—Continued.

Vol. XXII.* Issued for the Year 1868	Supplement to the Fossil Corals, Part II, No. 1, Cretaceous, by Dr. Duncan, 9 plates. The Fossil Merostomata, Part II, Pterygotus, by Mr. H. Woodward, 6 plates. The Fossil Brachiopoda, Part VII, No. 3, Silurian, by Mr. Davidson, 15 plates. The Belemnitidæ, Part IV, Liassic and Oolitic Belemnites, by Prof. Phillips, 7 plates. The Reptilia of the Kimmeridge Clay, No. 3, by Prof. Owen, 4 plates. The Pleistocene Mammalia, Part III, Felis spelæa, concluded, with F. lynx, by Messrs. W. Boyd Dawkins and W. A. Sanford, 6 plates.
„ XXIII.* „ 1869	Supplement to the Fossil Corals, Part II, No. 2, Cretaceous, by Dr. Duncan, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part III, by Dr. Wright, 10 plates. The Belemnitidæ, Part V, Oxford Clay, &c., Belemnites, by Prof Phillips, 9 plates. The Fishes of the Old Red Sandstone, Part I (concluded), by Messrs. J. Powrie and E. Ray Lankester, 9 plates. The Reptilia of the Liassic Formations, Part II, by Prof. Owen, 4 plates. The Crag Cetacea, No. 1, by Prof. Owen, 5 plates.
„ XXIV.* „ 1870	The Flora of the Carboniferous Strata, Part II, by Mr. E. W. Binney, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part IV, by Dr. Wright, 10 plates. The Fossil Brachiopoda, Part VII, No. 4, Silurian, by Mr. Davidson, 13 plates. The Eocene Mollusca, Part IV, No. 3, Bivalves, by Mr. S. V. Wood, 5 plates. The Fossil Mammalia of the Mesozoic Formations, by Prof. Owen, 4 plates.
„ XXV.* „ 1871	The Flora of the Carboniferous Strata, Part III, by Mr. E. W. Binney, 6 plates. The Fossil Merostomata, Part III, Pterygotus and Slimonia, by Mr. H. Woodward, 5 plates. Supplement to the Crag Mollusca, Part I (Univalves), by Mr. S. V. Wood, with an Introduction on the Crag District, by Messrs. S. V. Wood, jun., and F. W. Harmer, 7 plates and map. Supplement to the Reptilia of the Wealden (Iguanodon), No. IV, by Prof. Owen, 3 plates The Pleistocene Mammalia, Part IV, Felis pardus, &c., by Messrs W. Boyd Dawkins and W. A. Sanford, 2 plates. The Pleistocene Mammalia, Part V, Ovibos moschatus, by Mr. W. Boyd Dawkins, 5 plates.
„ XXVI* „ 1872	Supplement to the Fossil Corals, Part III (Oolitic), by Prof. Duncan, with an Index to the Tertiary and Secondary Species, 7 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part V, by Dr. Wright, 5 plates. The Fossil Merostomata, Part IV (Stylonurus, Eurypterus, Hemiaspis), by Mr. H. Woodward, 10 plates. The Trigoniæ, No. I, by Dr. Lycett, 9 plates.
„ XXVII* „ 1873	The Fossil Echinodermata, Cretaceous, Vol I, Part VI, by Dr. Wright, 8 plates. Supplement to the Fossil Brachiopoda, Part I (Tertiary and Cretaceous), by Mr. Davidson, 8 plates. Supplement to the Crag Mollusca, Part II (Bivalves), by Mr. S. V. Wood, 5 plates. Supplement to the Reptilia of the Wealden (Iguanodon), No. V, by Prof. Owen, 2 plates. Supplement to the Reptilia of the Wealden (Hylæochampsa) No. VI, by Prof. Owen. The Fossil Reptilia of the Mesozoic Formations, Part I, by Prof. Owen, 2 plates.

* These Volumes are issued in two forms of binding, first, with all the Monographs stitched together and enclosed in The cover; secondly, with each of the Monographs separate, and the whole of the separate parts placed in an envelope. The previous volumes are not in separate parts.

LIST OF MONOGRAPHS

Completed, in course of Publication, and in Preparation.

MONOGRAPHS which have been COMPLETED:—

The Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne Edwards and J. Haime.
The Polyzoa of the Crag, by Mr. G. Busk.
The Tertiary Echinodermata, by Professor Forbes.
The Fossil Cirripedes, by Mr. C. Darwin.
The Tertiary Entomostraca, by Prof. T. Rupert Jones.
The Cretaceous Entomostraca, by Prof. T. Rupert Jones.
The Fossil Estheriæ, by Prof. T. Rupert Jones.
The Tertiary, Cretaceous, Oolitic, Liassic, Permian, Carboniferous, Devonian, and Silurian Brachiopoda, by Mr. T. Davidson.
The Mollusca of the Crag, by Mr. S. V. Wood.
Supplement to the Crag Mollusca, by Mr. S. V. Wood.
The Great Oolite Mollusca, by Professor Morris and Mr. J. Lycett.
The Cretaceous (Upper) Cephalopoda, by Mr. D. Sharpe.
The Fossils of the Permian Formation, by Professor King.
The Reptilia of the London Clay (and of the Bracklesham and other Tertiary Beds), by Professors Owen and Bell.
The Reptilia of the Cretaceous, Wealden, and Purbeck Formations, by Professor Owen.
The Fossil Mammalia of the Mesozoic Formations, by Professor Owen.

MONOGRAPHS in course of PUBLICATION:*—

The Flora of the Carboniferous Formation, by Mr. E. W. Binney.
The Crag Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady.
Supplement to the Fossil Corals, by Dr. Duncan.
The Echinodermata of the Oolitic and Cretaceous Formations, by Dr. Wright.
The Fossil Merostomata, by Mr. H. Woodward.

* Members having specimens which might assist the authors in preparing their respective Monographs are requested to communicate in the first instance with the Honorary Secretary.

MONOGRAPHS in course of PUBLICATION—*Continued.*

The Trilobites of the Mountain-Limestone, Devonian, and Silurian Formations, by Mr. J. W. Salter.*
The Malacostracous Crustacea, by Professor Bell.
Supplement to the Fossil Brachiopoda, by Mr. T. Davidson.
The Trigoniæ, by Dr. Lycett.
The Eocene Mollusca, by Mr. S. V. Wood.
The Belemnites, by Professor Phillips.
The Fishes of the Old Red Sandstone, by Messrs. J. Powrie and E. Ray Lankester, and Professor Traquair.
The Reptilia of the Wealden Formation (Supplements), by Professor Owen.
The Reptilia of the Kimmeridge Clay, by Professor Owen.
The Reptilia of the Liassic Formations, by Professor Owen.
The Reptilia of the Mesozoic Formations, by Professor Owen.
The Pleistocene Mammalia, by Messrs. Boyd Dawkins and W. A. Sanford.
The Cetacea of the Crag, by Professor Owen.

* Unfinished through the death of the Author, but will be continued by Mr. H. Woodward.

MONOGRAPHS which are in course of PREPARATION :†—

The Flora of the Tertiary Formation, by Mr. W. S. Mitchell.
The Cretaceous Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady.
The Foraminifera of the Lias, by Mr. H. B. Brady.
The Graptolites, by Professor Wyville Thomson.
The Polyzoa of the Chalk Formation, by Mr. G. Busk.
The Palæozoic Polyzoa, by Dr. Duncan.
The Crinoidea, by Professor Wyville Thomson.
The Post-Tertiary Entomostraca, by the Rev. H. W. Crosskey and Messrs. G. S. Brady and D. Robertson.
The Wealden, Purbeck, and Jurassic Entomostraca, by Messrs. T. Rupert Jones and G. S. Brady.
The Bivalve Entomostraca of the Carboniferous Formations, by Messrs. T. Rupert Jones and J. W. Kirkby.
The Post-Tertiary Mollusca, by Mr. J. Gwyn Jeffreys.
The Cretaceous Mollusca (exclusive of the Brachiopoda), by the Rev. T. Wiltshire.
The Purbeck Mollusca, by Mr. R. Etheridge.
The Inferior Oolite Mollusca, by Mr. R. Etheridge.
The Rhætic Mollusca, by Mr. R. Etheridge.
The Liassic Gasteropoda, by Mr. Ralph Tate.
The Ammonites of the Lias, by Dr. Wright.

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† Members having specimens which might assist the authors in preparing their respective Monographs are requested to communicate in the first instance with the Honorary Secretary.

Dates of the Issue of the Yearly Volumes of the Palæontographical Society.

The Volume	for 1847	was	issued	to the	Members,	March, 1848.
,,	1848	,,		,,	,,	July, 1849.
,,	1849	,,		,,	,,	August, 1850.
,,	1850	,,		,,	,,	June, 1851.
,,	1851	,,		,,	,,	June, 1851.
,,	1852	,,		,,	,,	August, 1852.
,,	1853	,,		,,	,,	December, 1853.
,,	1854	,,		,,	,,	May, 1855.
,,	1855	,,		,,	,,	February, 1857.
,,	1856	,,		,,	,,	April, 1858.
,,	1857	,,		,,	,,	November, 1859.
,,	1858	,,		,,	,,	March, 1861.
,,	1859	,,		,,	,,	December, 1861.
,,	1860	,,		,,	,,	May, 1863.
,,	1861	,,		,,	,,	May, 1863.
,,	1862	,,		,,	,,	August, 1864.
,,	1863	,,		,,	,,	June, 1865.
,,	1864	,,		,,	,,	April, 1866.
,,	1865	,,		,,	,,	December, 1866.
,,	1866	,,		,,	,,	June, 1867.
,,	1867	,,		,,	,,	June, 1868.
,,	1868	,,		,,	,,	February, 1869.
,,	1869	,,		,,	,,	January, 1870.
,,	1870	,,		,,	,,	January, 1871.
,,	1871	,,		,,	,,	June, 1872.
,,	1872	,,		,,	,,	October, 1872.
,,	1873	,,		,,	,,	February, 1874.

SUMMARY OF THE MONOGRAPHS ISSUED TO THE MEMBERS (*up to* FEBRUARY, 1874): *showing in the* FIRST *column whether each Monograph hitherto published be* complete, *or in the* course of completion; *in the* SECOND *column, the yearly volumes which contain each particular Monograph (as a guide to binding the same); and in the* FOURTH *and following columns, the number of pages, plates, figures, and species described in the different Monographs.*

I SUBJECT OF MONOGRAPH.	II. Dates of the Years *for which* the volume containing the Monograph was issued.	III *m.* Dates of the Years *in which* the Monograph was published.	IV. No. of Pages of Letterpress in each Monograph.	V. No. of Plates in each Monograph.	VI. No. of Lithographed Figures and of Woodcuts.	VII. No. of Species described in the Text.
The Flora of the Carboniferous Strata, by Mr. E. W. Binney, in course of completion	1867, 1870, 1871	1868, 1871, 1872	96	18	110	15
The Crag Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady, in course of completion	1865	1866	78	4	211	43
Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne-Edwards and J. Haime, *complete (k)*	1849, 1851, 1852, 1853, 1854	1850, 1851, 1852, 1853, 1855	406	72	800	319*g*
Supplement to the Fossil Corals, by Prof. Duncan, in course of completion	1865, 1866, 1867, 1868, 1869, 1872	1866, 1867, 1868, 1869, 1870, 1872	232	49	797	149
The Polyzoa of the Crag, by Mr. G. Busk, *complete*	1857	1859	145	22	641	122
The Tertiary Echinodermata, by Prof. Forbes, *complete*	1852	1852	39	4	144	44
The Oolitic Echinodermata, by Dr. Wright. Vol. I, *complete (l)*	1855, 1856, 1857, 1858	1857, 1558, 1859, 1861	474	43	724	109*h*
,, ,, Vol. II, in course of completion	1861, 1864	1863, 1866	154	19	218	29
The Cretaceous Echinodermata, by Dr. Wright. Vol. I, in course of completion	1862, 1867, 1869, 1870, 1872, 1873	1864, 1868, 1870, 1871, 1872, 1874	224	58	774	66
The Fossil Cirripedes, by Mr. C. Darwin, *complete*	1851, 1854, 1858*a*	1851, 1855, 1861	137	7	320	54
The Fossil Merostomata, by Mr. H. Woodward, in course of completion	1865, 1868, 1871, 1872	1866, 1869, 1872, 1872	180	30	249	35
The Tertiary Entomostraca, by Prof. Rupert Jones, *complete*	1855	1857	74	6	233	56
The Cretaceous Entomostraca, by Prof. Rupert Jones, *complete*	1849	1850	41	7	176	27
The Fossil Estheriæ, by Prof. Rupert Jones, *complete*	1860	1863	139	5	158	19*i*
The Trilobites of the Mountain-limestone, Devonian, Silurian, and other Formations, by Mr. J. W. Salter (incomplete through the Author's death)	1862, 1863, 1864, 1866	1864, 1865, 1866, 1867	216	31	703	114
The Malacostracous Crustacea (comprising those of the London Clay, Gault, and Greensands), by Prof. T. Bell, in course of completion	1856, 1860	1858, 1863	88	22	215	50
Fossil Brachiopoda, Vol. I. The Tertiary, Cretaceous Oolitic, and Liassic Brachiopoda, by Mr. T. Davidson, *complete*	1850, 1852, 1853, 1854	1851, 1852, 1853, 1855	409	42	1855	160
,, ,, Vol. II. The Permian and Carboniferous Brachiopoda, *complete*	1856*d*, 1857, 1858, 1859, 1860	1858, 1859, 1861, 1861, 1863	331	59	1909	157
,, ,, Vol. III. The Devonian and Silurian Brachiopoda, *complete*	1862, 1863, 1865, 1866, 1868, 1870	1864, 1865, 1866, 1867, 1869, 1871	528	70	2766	321
Supplement to the Fossil Brachiopoda, by Mr. Davidson, in course of completion	1873	1874	72	8	317	47
The Trigoniæ, by Dr. Lycett, in course of completion	1872	1872	52	9	89	33
		CARRIED FORWARD...	4115	585	13,409	1969

Summary of the Monographs issued to the Members (*up to* FEBRUARY, 1874)—*continued.*

I. Subject of Monograph.	II. Dates of the Years *for which* the volume containing the Monograph was issued.	III *m.* Dates of the Years *in which* the Monograph was published.	IV. No. of Pages of Letterpress in each Monograph.	V. No. of Plates in each Monograph.	VI. No. of Lithographed Figures and of Woodcuts.	VII. No. of Species described in the Text.
		Brought forward...	4115	585	13,409	1969
The Mollusca of the Crag, by Mr. S. V. Wood:—						
Vol. I. (Univalves), *complete*	1847, 1855*b*	1848, 1857	216	21	581	244
Vol. II. (Bivalves), *complete*	1850, 1853, 1855, 1858*c*	1851, 1853, 1857, 1861	344	31	691	253
Supplement to the Crag Mollusca, by Mr. S. V. Wood, *complete*	1871, 1873	1872, 1874	262	12	360	172
The Eocene Mollusca, Cephalopoda and Univalves, by Mr. F. E. Edwards, in course of completion	1848, 1852, 1854, 1855, 1858	1849, 1852, 1855, 1857, 1861	332	33	578	161
The Eocene Mollusca, Bivalves, by Mr. S. V. Wood, in course of completion	1859, 1862, 1870	1861, 1864, 1871	182	25	531	194
The Great Oolite Mollusca, by Prof. Morris and Dr. Lycett, *complete*	1850, 1853, 1854	1850, 1853, 1855	282	30	846	419
„ „ „ Supplement by Dr. Lycett, *complete*	1861	1863	129	15	337	194
The Belemnites, by Prof. Phillips, in course of completion	1863, 1864, 1866, 1868, 1869	1865, 1866, 1867, 1869, 1870	128	36	622	69
The Upper Cretaceous Cephalopoda, by Mr. D. Sharpe, *complete*	1853, 1854, 1855	1853, 1855, 1857	67	27	319	79
The Fossils of the Permian Formation, by Prof. King, *complete*	1849, 1854*e*	1850, 1855	287	29	511	138
The Fishes of the Old Red Sandstone, by Messrs. J. Powrie and E. Ray Lankester, in course of completion	1867, 1869	1868, 1870	62	14	195	21
The Reptilia of the London Clay [and of the Bracklesham and other Tertiary Beds], by Profs. Owen and Bell, *complete* ‡	1848, 1849, 1856*f*	1849, 1850, 1859	150	58	304	39
The Reptilia of the Cretaceous Formations, by Prof. Owen, *complete* ‡	1851, 1857, 1858, 1862	1851, 1859, 1861, 1864	184	59	519	26
The Reptilia of the Wealden and Purbeck Formations, by Prof. Owen, *complete* ‡	1853, 1854, 1855, 1856, 1857, 1858, 1862	1853, 1855, 1857, 1858, 1859, 1861, 1864	155	62	251	17
The Reptilia of the Wealden Formations (Supplements) in course of completion	1871, 1873	1872, 1874	40	5	50	2
The Reptilia of the Kimmeridge Clay Formation, by Prof. Owen, in course of completion	1859, 1860, 1868	1861, 1863, 1869	16	6	23	3
The Reptilia of the Liassic Formations, by Prof. Owen, in course of completion	1859,‖ 1860,‖ 1863, 1869	1861, 1863, 1865, 1870	121	37	177	8
The Crag Cetacea, by Prof. Owen, in course of completion	1869	1870	40	5	43	7
The Pleistocene Mammalia, by Messrs. W. Boyd Dawkins and Mr. W. A. Sanford, in course of completion	1864, 1867, 1868, 1871	1866, 1868, 1869	266	32	250	7
The Fossil Mammalia of the Mesozoic Formations, by Prof. Owen, *complete*	1870	1871	115	4	247	30
The Fossil Reptilia of the Mesozoic Formations, by Prof. Owen, in course of completion	1873	1874	14	2	40	10
		Total	7507	1128	20,884	4062

a Index. *b* Title-page to Univalves. *c* Note to Crag Mollusca. *d* Contains the Permian. *e* Two corrections of Plates. *f* Supplement.
g Many of the species are described, but not figured. *h* British species only reckoned. *i* British species only reckoned. *k* A Supplement is now in course of publication.
l Wants Index. *m* Useful for establishing the dates of new species.
‡ Title-pages and Index will be found in the 1864 Volume, or may be had separately. ‖ Marked on outside label 'Reptilia of Oolitic Formations.'

STRATIGRAPHICAL TABLE *exhibiting the* BRITISH FOSSILS *already figured and described in the* ANNUAL VOLUMES (1847—1873) *of the* PALÆONTOGRAPHICAL SOCIETY.

	PLANTS.	PROTOZOA.		RADIATA.		ARTICULATA.						MOLLUSCA.				VERTEBRATA.		
		Sponges.	Foraminifera.	Corals.	Echinodermata.	Cirripedes.	Cypridæ, Cytherinæ, &c.	Estheriæ.	Merostomata.	Trilobites.	Malacostracous Crustacea.	Polyzoa.	Brachiopoda.	Monomyaria, Dimyaria, and Gasteropoda.	Cephalopoda.	Fishes.	Reptiles.	Mammalia.
Pleistocene ...	...	...	...	...	......	......	...	...	......	......	...	...	1873	......	...	...	......	1864, 1867, 1868, 1871
Crag	...	...	1865	1849	1852	1851, 1854	...	...	......	......	...	1857	1852 1873	1847, 1850, 1853, 1855, 1871, 1873	...	...	......	1869
Eocene	...	...	...	1849 1865	1852	1851, 1854	1855	...	......	......	1856	...	1852 1873	1852, 1854, 1855, 1858, 1859, 1862 1870	1848	...	1848, 1849, 1856	
Cretaceous ...	...	...	...	1849 1868 1869	1862, 1867, 1869, 1870, 1872, 1873	1851, 1854	1849	...	......	......	1860	...	1852, 1854, 1873	1872	1853 1854 1855	...	1851, 1857, 1858, 1862	
Wealden	...	...	...	...	......	......	...	1860	......	......	...	...	......	......	...	...	1853, 1854, 1855, 1856, 1857, 1862, 1871, 1873	
Oolitic	...	...	...	1851 1872	1855, 1856, 1857, 1858, 1861	1851	...	1860	......	......	...	...	1850, 1852	1850, 1853, 1854 1872	1850 1861 1868 1869	...	(Purbeck) 1853, 1858 (Kim. Clay), 1859, 1860, 1868, 1873	1870
Liassic	...	...	...	1851 1866 1867	1855, 1856, 1858, 1861, 1864	......	...	...	......	......	...	...	1850, 1852	......	1863 1864 1866 1868	...	1859, 1860, 1863, 1869, 1873	
Triassic	...	...	...	...	......	......	...	1860	......	......	...	...	......	......	......	......	......	1870
Permian	1849	1849	1849	1849 1852	1849	......	1849	1860	......	......	...	1849	1849, 1856	1849	1849	1849	1849	
Carboniferous	1867 1870 1871	...	...	1852	......	......	...	1860	1872	......	...	...	1856, 1857, 1858, 1859, 1860					
Devonian	...	...	...	1853	......	......	...	1860	1865, 1868, 1872	1862	...	...	1862, 1863	......	...	1867 1869		
Silurian	...	...	...	1854	......	......	...	...	1868, 1871, 1872	1862, 1863 1864, 1866	...	...	1865, 1866 1868, 1870					
Cambrian	...	...	...	...	......	......	...	...	......	1864								

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1873.

LONDON:
MDCCCLXXIV.

MONOGRAPH

ON THE

BRITISH FOSSIL

ECHINODERMATA

FROM

THE CRETACEOUS FORMATIONS.

BY

THOMAS WRIGHT, M.D., F.R.S. EDIN., F.G.S.,

CORRESPONDING MEMBER OF THE ROYAL SOCIETY OF SCIENCES OF LIÈGE, THE SOCIETY OF NATURAL SCIENCES OF NEUFCHATEL; SENIOR SURGEON TO THE CHELTENHAM HOSPITAL; AND MEDICAL OFFICER OF HEALTH FOR THE URBAN SANITARY DISTRICTS OF CHELTENHAM, CHARLTON-KINGS, AND LECKHAMPTON.

VOLUME FIRST.

PART SIXTH.

ON THE ECHINOCONIDÆ.

PAGES 185—224; PLATES XLV—LII.

LONDON:

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1874.

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J. E. ADLARD, BARTHOLOMEW CLOSE.

close-set mammillated granules, twenty-six in each row, larger at the base than in the upper part of the area. Within these are two rows of much smaller granules, twenty-two in each, less regular in their arrangement than the marginal rows (fig. 1 *g*). The poriferous zones are extremely narrow and the pores disposed in very oblique pairs (fig. 1 *g*), eight lying within the height of one of the large inter-ambulacral plates (fig. 1 *i*); the septum between each pair terminates in a granuliform elevation (fig. 1 *i*).

The inter-ambulacral areas are well developed (fig. 1 *a, d, f*), with two rows of tubercles, seven in each; those in the upper part of the area and at the ambitus are large, and at the base small; fig. 1 *f* shows one area magnified four diameters; the three pairs of large tubercles nearly occupy the entire surface of their respective plates (fig. 1 *i*); the boss has a wide base, surrounded by a well-defined areola, and this is encircled by a series of eight large mammillated granules; fig. 1 *i* shows one of these large plates, and fig. 1 *k* gives a profile of one tubercle with its surrounding granules, both figures are magnified six diameters; from the ambitus to the peristome the tubercles gradually diminish in size, and the four small basal nearest the mouth have a row of mammillated granules separating them from the poriferous zones (fig. 1 *f* and fig. 1 *h*). The miliary zone is wide, nearly of equal diameter throughout; and in addition to the large granules which form a series of crescents around the areolæ the interspace is covered with small granules sparsely strewed over the surface of the plates (fig. 1 *d, g, f*). The apical disc is large and prominent, consisting of a series of thick plates; fig. 1 *a* shows its natural size and relations, and fig. 1 *i* the same magnified four diameters. Three of the ovarial plates have an irregular hexagonal and two a rhomboidal figure (fig. 1 *b* and *e*); in all the oviductal holes are in the centre of the plates; the sur-anal plate is much thickened and raised to form the anterior wall of the periprocte (fig. 1 *a, b, d, e*); the ocular plates are triangular, having their base undulated and turned outwards: the outer border of both the ovarial and ocular plates are placed within the circle having its centre at the anterior wall of the vent; the sutures are well marked and punctated with small angular impressions; the vent is large and oblong (fig. 1 *b, e*), and the periprocte surrounded by a thick prominent annulus, which forms a conspicuous character of the test of this fine Salenia; the vent is excentral (fig. 1 *a, d*), and looks obliquely backwards and to the right side. The base is narrow, and highly ornamented; the small primary inter-ambulacral tubercles are closely set together, and the large mammillated ambulacral granules are very conspicuous, and form a prominent band between the tubercles (fig. 1 *c, h*); the miliary zone is wide, and filled with small close-set granules (fig. 1 *f, c*). The mouth-opening is oblong (fig. 1 *c, l*) about one third the diameter of the test. The peristome is decagonal, dividing the opening into ten unequal lobes; each of the ambulacral lobes, which are the largest, have a double crescentic outline, fig. 1 *h, l*: this is the only species of the genus *Salenia* which possesses an oblong mouth-opening, and this forms, therefore, one of the specific characters by which it is distinguished from its congeners.

Affinities and Differences.—This magnificent *Salenia* in point of size resembles *S. geometrica*, var. *Portlockii*, from the White Chalk. The test, however, is more elevated, the apical disc thicker and more prominent, and the inter-ambulacral areas resemble each other in the number and development of the tubercles in each row; the oblong vent and oblong mouth-opening are, however, special to *S. magnifica*.

Locality and Stratigraphical Position.—This Urchin was collected from the Upper Chalk near Norwich, and belongs to the British Museum collection.

Genus—Cottaldia, *Desor*, 1856.

Echinus, pars, *Kœnig*, 1820; *Münster*, 1826; *Forbes*, 1849. Arbacia, *Gray*, 1835.
Cottaldia, *Desor*, 1856.

Test small, sub-globular, sides inflated, more or less depressed at the poles. Shell lobed, divided into fifteen sections; the five most prominent form the ambulacral, and the ten others, grouped in pairs, the inter-ambulacral areas. Poriferous zones narrow, straight; pores unigeminal. Tubercles small, mammillated, imperforated, uncrenulated, very numerous, homogeneous, and forming on each plate a close-set horizontal row. Granules microscopic, placed on all the inter-tubercular spaces. Apical disc solid, narrow, forming a prominent ring, composed of five perforated, rhomboidal, ovarial plates, and five cordate oculars; all the elements of the disc are covered with close-set granules. Mouth-opening moderate, lodged in a concave depression of the base; peristome sub-pentagonal, decagonal, and feebly notched.

The genus *Cottaldia* forms a very natural group of small fossil Urchins appertaining to the Cretaceous and Tertiary formations; well characterised by their sub-globular form, and the abundance and uniformity of their tubercles, arranged in horizontal series over the entire test. Much confusion formerly existed between Arbacia, *Gray;* Echinocidaris, *Desmoulins;* Polycyphus, *Agassiz;* and Magnosia, *Michelin.* This, however, has been in a great measure removed by clearer definitions of the genera retained, the suppression of those that were doubtful, and the establishment of the genus *Cottaldia*.

The uniformity of the tubercles, Prof. Desor remarks, attains its maximum in this small genus; and this character accords with its peristome, which is narrow and depressed, and its pores, which are unigeminal throughout the zones. These characters distinguish *Cottaldia* from the neighbouring types with which it has been confounded up to the present time. It is dedicated by M. Desor in honour of his friend M. Cotteau, the learned author of the 'Échinides fossiles de l'Yonne,' and of the 'Paléontologie Française.'

Cottaldia Benettiæ, *König*. Pl. XLV, figs. 1, 2, 3.

Echinus benettiæ,	*König*. Icones Foss. Sectiles, p. 2, pl. iii, fig. 35, 1825.
— granulosus,	*Münster*, Pet. Germ., p. 125, pl. xlix, fig. 5, *a. b*, 1826.
— —	*Grateloup*. Mém. Oursins Fossiles, Échinides, p. 82, 1836.
Arbacia granulosa,	*Agassiz*. Cat. Syst., p. 12.
— —	*Morris*. Cat. of British Fossils, p. 48, 1843.
— —	*Agassiz* et *Desor*. Cat. Rais. des Échinides, Ann. des Sc. Nat., 3rd series, vol vi, p. 356.
Echinus granulosus,	*Forbes*. Mem. Geol. Surv. Organic Remains, Decade I, pl. vi, 1849.
— —	*Forbes* in *Morris*. British Fossils, 2nd ed., p. 79, 1854.
Cottaldia granulosa,	*Desor*. Synop. des Échinid. Foss., p. 114, pl. xix, fig. 1—3, 1858.
— —	*Cotteau*. Paléontologie Française, Ter. Cretacé, t. vii, p. 789, pl. 1193 and 1194, 1—9, 1866.

Diagnosis.—Test small, globular, nearly equally depressed at both poles; plates of both areas very narrow, the inter-ambulacral supporting a horizontal series of small, equal-sized, imperforate, spiniferous tubercles, from eight to twelve in a row; the ambulacral tubercles of the same size, less numerous, and packed obliquely together; poriferous zones very narrow, pores unigeminal throughout; apical disc very small; mouth-opening large, placed in a depression; peristome slightly decagonal, notches feebly marked.

Dimensions.—Altitude, nine twentieths of an inch; latitude, six tenths of an inch; the relation of the altitude to the latitude varies considerably, some being more conical, others more depressed than others; in four specimens the ratio was 17 to 10, 15 to 11, 12 to 11, and 12 to 8.

Description.—This beautiful little Urchin was first figured by M. König in his 'Icones Fossilium Sectiles' under the name of *Echinus Benettiæ*, in honour of a lady who had long made the fossils of Wiltshire her especial study, and had published a valuable catalogue of the same; a year later the German forms of this species were figured and described in Goldfuss' 'Petrefacta Germaniæ' under Count Münster's name *Echinus granulosus;* subsequently it was entered in Agassiz and Desor's 'Catalogue Raisonné des Échinides' at the head of the list of their second type of *Arbaciæ* with uniform tubercles on all the surface of the test; and, lastly, M. Desor established the genus *Cottaldia* for this small group, which was characterised by having the surface of the small test covered with spiniferous tubercles, uniform in size and regular in arrangement,

forming distinct horizontal rows on the plates of the inter-ambulacra, and having the pores unigeminal throughout the narrow areas.

The test varies in form in different individuals from nearly a globular shape, as in Pl. XLV, fig. 1, to forms more or less depressed at both poles, as in figs. 2 and 3. The uniformity in size and arrangement of the numerous small tubercles covering the surface, and the division of the same into five broad and five narrow segments (fig. 1 *d*), by the poriferous zones radiating from the circumference of the apical disc (fig. 1 *b*) and converging below around the peristome (fig. 1 *c*), impart a remarkable physiognomy to this pretty little Urchin; the medial suture down the middle of the inter-ambulacra is often depressed, and then *Cottaldia Benettiæ* resembles a little melon, having its surface divided into fifteen lobes (fig. 1 *b*, *d*).

The ambulacral areas are about one third the width of the inter-ambulacral, and at the ambitus there are three or four tubercles on each plate (fig. 2 *b*), with numerous small granules around them; the outer rows of tubercles are the most persistent, and the inner rows in general are limited to the ambital region of the test; the poriferous zones are very narrow, and the pores numerous and unigeminal throughout (fig. 2 *b*); near the base they show a disposition to fall into triple oblique pairs, as in the genus *Echinus*, but the deviation is so slight that it is only occasionally seen in exceptional specimens; there are in general three pairs of holes opposite each ambulacral plate (fig. 1 *e* and fig. 2 *b*), so that in the specimen I am describing there are quite 100 pairs of holes in each zone.

The inter-ambulacral areas are three times as wide as the ambulacral; the plates are very narrow in proportion to their length, and in the specimen before me there are thirty-five plates in each column; each plate has a horizontal series of small equal-sized spiniferous tubercles; in the longest plates at the ambitus there are from nine to eleven on each according to the age and size of the specimen under examination; the tubercles of both areas are of the same size, but they are rather more closely set together, and more obliquely placed in consequence in the ambulacral areas (see fig. 1 *e* and fig. 2 *b*); the number of tubercles in each vertical row varies with the age and size of the specimen; they are most numerous near the ambital region; the rows nearest the poriferous zones are the longest and most persistent, and those near the miliary zone the shortest and most frequently absent. In some large specimens there is a depression in the line of the median suture in the inter-ambulacral areas, which gives this space a bilobed appearance; as these areas are nearly half the width of the ambulacral, the whole circumference of the test is divided by the five sutural depressions into ten poriferous zones and fifteen well-marked lobes, as represented in fig. 1 *a*, *b*, *c*, *d*, and this imparts a remarkable symmetrical neatness to the physiognomy of the Urchin.

The mouth-opening is nearly circular, and about one half the diameter of the test (fig. 1 *c*); the peristome, which is superficial, is very feebly notched opposite the zones.

The apical disc is a small ring-like structure slightly projecting from the surface of the test (fig. 1 *b*); the ovarial plates are sub-triangular (fig. 1 *b*), and perforated near

their outer third by a large oviductal hole; the madreporiform tubercle is feebly developed and occupies the inner portion of the right antero-lateral plate; in most specimens the ocular plates are small and angularly reniform, the orbit is excavated out of the centre of their outer margin, the elements of the disc are covered with numerous small granules, which are closely crowded together on the surface of all the plates.

The test is extremely thin, and the spines are at present unknown.

Affinities and Differences.—There are very few species in the genus *Cottaldia*. *C. conica*, Agass., is merely an elevated form of *C. granulosa; C. Buchii*, Steiniger, is a nearly allied species, from a Tertiary rock at Rommelsheim, near Früm.

Locality and Stratigraphical Position.—This Urchin was formerly very abundant in the Upper Greensand of Warminster, and at Chute Farm, Wilts. On the Continent the first-described specimens were collected at Regensburg, Bavaria. In France, according to M. Cotteau, it is found at Villers-sur-mer (Calvados); le Havre, Rouen (Seine-Inférieure); Vimoutiers, La Perrière (Orne); La Madeleine (Eure); le Mans, Coulaine, Yvré-l'Evêque, les Bordiers, Nogent-le-Bernard, Gavillé (Sarthe); Cherves-de-Cognac (Charente-Inférieure); La Bedoule (Var); very abundant in the Étage Cénomanien = Upper Greensand; Environs of Royan (Charente-Inférieure); very rare in the Étage Sénonien = Lower Chalk.

ECHINOIDEA EXOCYCLICA, *Wright*, 1855.

Before entering upon the study of the Echinoidea exocyclica, it is due to the Echinological student to state in general terms the reasons that have led to the adoption of names for several generic groups so different from those in general use at the present time. In working out the materials for these Monographs it has been my most earnest endeavour to do justice to my predecessors and contemporaries in the same field of labour, by observing the most scrupulous care in reference to priority of date in each genus and species founded on figures or descriptions, or both; without a rigorous base of equity on this fundamental principle, it would be vain to hope for the stability of any system of nomenclature, or limits to the interminable list of synonyms which would result from its neglect. In every case, therefore, I have traced back the history of each genus and species to its original author, and have added his name and the date after each, so that justice is done to every naturalist who has enriched our science by original work. The following remarks were made in the preface to my Monograph on the Oolitic

Echinodermata, and twenty years' experience has only afforded additional evidence of their truth.

"Many of the readers of this Monograph will probably be surprised to find some old generic names reproduced which have been long superseded by those of modern writers; but a sense of justice to such authors as Van Phelsum, Breynius, Klein, and Leske has led me to consult their original works and restore the genera first described and figured by them, but omitted from the treatises of later authors on the same subject.

"In the nomenclature of the *Echinodermata*, had I merely gone back to the time of Linnæus, as suggested by the Committee of the British Association in their Report made in 1842, I must necessarily have excluded the important work by Breynius,[1] in which, for the first time, were proposed seven well-described and accurately figured genera of *Echinoidea*, which, by some strange oversight, were not adopted by his contemporaries, although they have reappeared under new names in the works of later authors. On the principle of priority, therefore, I have restored the original genera so clearly defined by Breynius, even although it may occasion a temporary inconvenience in the names of some well-known forms of Urchins.

"In every case where practicable the name of the author who either first recorded, described, or figured the species follows the specific name of the object without the addition of 'Sp.' adopted by some authors. By this mode justice is done to the original author and confusion avoided. The modern practice of inventing new generic terms and appending to the old specific name that of the individual who has merely changed a word but discovered nothing cannot be sufficiently discountenanced, as it increases the confusion arising from an overloaded synonymy, and thereby retards the real progress of the natural-history sciences."[2]

The first author who described systematically and figured accurately many typical forms of *Echinidæ* was undoubtedly Breynius,[3] in his 'Schediasma de Echinis;' he takes the general form of the test and relative position of the vent as the basis of his methodical arrangement, in which he groups the whole order into the seven following genera.

I. *Genus*—Echinometra, *Breynius*, 1732.

Shell more or less globular, the mouth and vent occupying the two poles. This genus was retained by Gaultieri, 1742; by Seba, 1758, and by Van Phelsum, 1770; but it

[1] De Echinis et Echinitis, sive methodica Echinorum distributione, Schediasma. Gedani, 1732.

[2] 'Monograph on the British Fossil Echinodermata of the Oolitic Formation,' p. vii, Pal. Soc. vol. for 1855.

[3] Joannis Phillippi Breynii dissertatio physica de Polythalamiis—tandemque Schediasma de Echinis methodice disponendis cum figuris. Gedani, 1732.

was changed into *Cidaris* by Klein, in 1734, into *Echinus* by Linnæus, in 1758, and into *Echinus* and *Cidaris* by Lamarck in 1801, who suppressed the name *Echinometra* altogether. It has been restored to another group of Urchins by Agassiz in 1846, who unfortunately attributed the name to Klein instead of Breynius its author.

II. *Genus*—Echinoconus, *Breynius*, 1732.

The mouth in the centre of the base, and the vent beneath, at the margin, or above the border; the shell elevated, round, or conoidal. This generic name was ignored by Klein, 1734, who changed it to *Conulus;* Leske, his commentator in 1778, changed it to *Echinites.* Lamarck, 1801, omitted the names proposed by his predecessors, and gave that of *Galerites* to the same group; all the authors down to the time of Alcide d'Orbigny have followed Lamarck instead of Breynius, who nearly a century before had well described and figured this genus.

III. *Genus*—Echinocorys, *Breynius*, 1732.

The test is helmet-shaped, with the mouth and vent beneath, the former aperture before, and the latter at the marginal border. This generic name was ignored by Klein and changed by him to *Galea* in 1734. It was retained by Leske, 1778, by Parkinson, 1811, and Mantell, 1832. Lamarck in 1801 proposed the new name *Ananchytes* for this group, which was retained and adopted by all subsequent modern authors down to 1853, when d'Orbigny restored to this form Breynius' original name *Echinocorys.*

IV. *Genus*—Echinanthus, *Breynius*, 1732.

Large, oblong, shield-shaped Urchins with petaloidal, ambulacral areas, the mouth-opening beneath near the centre, and the vent within or below the marginal border; this genus was preserved by Gaultieri, 1742, and Leske, 1778. It was changed into *Scutum* by Klein, 1734; into *Clypeaster* by Lamarck, 1816; and into *Echinolampas* by Gray in 1834. Agassiz and most other modern authors retained the name *Echinolampas* until d'Orbigny rightly restored the old original name *Echinanthus* to all oblong Urchins with leaf-shaped ambulacra and the vent in the lower border.

V. *Genus*—ECHINOSPATAGUS, *Breynius*, 1732.

Heart-shaped Urchins, with inflated sides, the ambulacra on the upper surface lodged in depressions of the test; the mouth anterior between the centre and the border; the vent on the upper part of the posterior border in a direction oblique to that of the mouth. This name was changed by Klein, 1734, to *Spatangus*, adopted by Lamarck and all subsequent authors. As the genus *Echinospatagus* represents a natural family rather than a genus, one of the forms figured by Breynius among his types ought to bear this generic name, whilst the other genera might be readily arranged around the central type form.

VI. *Genus*—ECHINOBRISSUS, *Breynius*, 1732.

Small buckler-shaped Urchins more or less depressed, the mouth-opening near the centre of the base, vent debouching into a deep dorsal sulcus, ambulacral areas petaloidal. The specimen figured as the type of this genus is one of the most common Oolitic forms. Still no author has cited this genus, and it appears to have been overlooked until Lamarck described it under the name *Nucleolites*.

VII. *Genus*—ECHINODISCUS, *Breynius*, 1732.

Discoidal Urchins with the mouth and vent opening near each other at the base. The ambulacra limited, petaloidal, and dorsal. Shell always flat; border thin, entire, or often indented or perforated. This genus was adopted by Gaultieri, 1742, and by Seba, 1758; by Leske and Davila, 1778. It was changed to *Rotula* by Klein, 1734, and into *Scutella* by Lamarck, 1801.

The 'Dissertatio Physica de Polythalamiis, de Belemnitis, de Echinis,' by Breynius, is a very scarce book. After endeavouring in vain to obtain it in commerce, I made known my want to my friend Professor de Koninck, of Liége, who kindly gave me the copy I now possess. In discussing many years ago the merits of this work with my old friend the Rev. Robert Hepworth, M.A., he kindly offered to make a translation for my Monograph of that portion of the dissertation which related to the classification of the *Echinodermata*, for which I heartily thank him, and I have now the pleasure of adding the version as it came from his pen. I have inserted such references to the plates of this Monograph as will help the reader to supply the absence of the original plates which accompany the work of Breynius.

"De Echinis et Echinitis, sive methodica Echinorum Distributione, Schediasma Joannis Philippi Breynii, M.D., et Societ. Reg. Lond. Sodalis."

"Genus I.—*The* Echinometra *is an Echinus with the oral aperture placed in the centre of the base, but with the anal one diametrically opposite at the summit.*

The term *Echinometra* occurs in Aristotle, who designates by it the largest genus of *Echini*. Naturalists dispute whether, on this point, regard must be had to the size of the spines, or of the test. Bellonius and his followers determine the latter. Hence I think that this name is not inappropriately affixed to this *Echinus*, since those belonging to this genus are found equal in size to an infant's head. There is this additional peculiarity, that this genus, among all the *Echini*, is provided with very large spines and tubercles. Its common name is *Ovarius*.

The *Echinometra* has many peculiarities which distinguish it from other *Echini*, besides the position of the apertures.

1. Internally there are five testaceous teeth, each elaborately composed of several parts, and surrounded by testaceous semicircles, which are situated internally around the oral aperture. Some species of *Echinanthus* are also furnished with teeth, but of a different structure.

2. The test is divided into five equal or nearly equal areas.

3. Externally it is rendered rough by tubercles, greater or smaller according to regular series, placed for the purpose of receiving the sockets of the spines; whilst in the other *Echini* all the tubercles are nearly equal in size and very small.

4. In like manner it has the primary and secondary spines more or less large and unequal in size, whilst all the spines of other *Echini* are very small, and generally of equal size.

5. I have also especially observed near the anal aperture a small warty substance [the madreporiform body], which can be more clearly distinguished with a lens, and similar to that which Linck first detected in the Star-fish, the use of which in that animal will doubtless throw light also upon this species of the *Echinometra*."

[Plates V and VI of this work represent typical forms of this group.]

"Genus II.—*The* Echinoconus *is an Echinus, whose apertures are both in the base, the oral in the centre, and the anal at or in the margin.*

It is either of a conical figure (the *Echinites pileatus* of Luidius), or hemispherical, or more or less compressed or oval. All of them have five duplicate pointed lines extending from the vertex to the oral aperture.

I have observed various fossil species of this genus, but only one recent species.

I have given it the name of Echinoconus from the conical figure which certain species possess.

Table II, fig. 1.—The Echinoconus verè conicus; perfectly conical, fossil; filled with cretaceous matter. From the Kent chalk pits. The *Echinites pileatus*, with either a conoid figure, or somewhat turbinated. [Plates XLIX and L of this work.]

Fig. 2. The base of the same, in which may be observed the oral aperture in the centre and the anal in the margin. [Plate L, fig. 1. *Echinoconus conicus*, Brey.]

Fig. 3. The Echinoconites hemisphæricus ferme, nearly hemispherical, consisting of siliceous matter, or of what is commonly called hornstone. [Plate LIII, fig. 2 *c*, *d*.]

Fig. 4. The base. [Plate LIII, fig. 2 *b*. *Echinoconus subrotundus*.]

Fig. 5. Echinoconus ovalis, the anal aperture near the margin. This is the only recent one known to me; it does not exceed half an inch in size, is fragile, and with a whitish shell.

Fig. 6. The base.

Genus III.—*The* Echinocorys *is an Echinus with both apertures in the base, the oral between the centre and the margin, and the anal as distant as possible from the mouth in the margin itself.*

All those which have come under my observation approximate in some measure in their form to that of a helmet. Hence they are termed by Luidius in his 'Lithophylacium Britannicum' *galeati* or helmeted.

I have designated the genus *Echinocorys* for the same reason, as Κόρυς among the Greeks signified a helmet or casque. Hitherto I have observed no recent specimen of this genus, but many fossil ones.

Table III, fig. 1. The Echinocorys vulgaris; fossil, filled with cretaceous matter, from the chalk pits near Gravesend, Kent. This is the common helmeted *Echinites* of Luidius.

Fig. 2. The base of the same, with two apertures; the upper one is the mouth, the lower the anus."

"Fig. 3. The ECHINOCORYTA, like marble, ashy grey, representing with the greatest exactness the internal face of the shell. [This is a siliceous mould of an *Echinoconus.*]

Fig. 4. The base. [Siliceous mould of the base of a small *Echinocorys vulgaris.*]

Genus IV.—*The* ECHINANTHUS *is an Echinus whose oral aperture is near the centre, and the anal upon or at that part of the margin which is at the greatest distance from the oral.*

All the species of this genus have an oval figure, one extremity of which is narrower, the other broader, in which latter the anal aperture is always situated; but the poriferous zones in the upper surface resemble a five-petaled flower, as though they were artificially marked by a needle; and for this reason I have assigned to this genus the name of *Echinanthus* or Urchin flower.

It is termed by Woodward *Echinus pentaphylloides, i. e.*, five-leaved, and is represented as having only one foramen in the centre of the base; whereas, on the contrary, the other foramen is conspicuous upon or at the margin in both the fossil and the recent species.

Fig. 1. The ECHINANTHUS, with the vertex (upper surface) more or less raised, of a whitish colour. From the Kleinian Museum. This species seems to approximate in the outward shape of an helmet to the *Echinocorys*, but it differs from it sufficiently in the position of the mouth, and in the likeness of the flower at the summit.

Fig. 2. The base. This fossil *Echinanthus*, filled with chalky matter, is depicted in the 'Museum Amboinæ,' Tab. LIX, fig. D.

Fig. 3. An *Echinanthus* of flatter form; fossil; filled with stony matter. From Monte Baldo, near Verona; remarkable for the upper surface with the anal aperture.

Fig. 4. An *Echinanthus* with the dorsal region more or less raised along its length; fossil; filled with stony matter of an ashy colour.

Fig. 5. The base. The oral aperture near the centre, the anal on the margin. In this genus the anal aperture is generally so situated that it can be viewed equally well from both the summit and the base. On this account I am the more astonished that Woodward should have overlooked it."

[Plate LVIII, *Pygurus lampas,* represents a type form of this genus.]

"Genus V.—The ECHINOSPATAGUS *is an Echinus whose oral aperture is between the centre and the margin, but the anal is situated obliquely opposite to the mouth upon or at the margin towards the summit.*

The figure is usually heart-shaped, the furrow being on the upper surface at the broader extremity; or it is oval without a furrow of that kind. But the anal aperture is always observable in the narrow extremity, as in the *Echinanthus.* In some species there is also, it appears, some representation of a flower, as in my *Echinanthus,* but this consists not of *five* but of only *four* petals, and those of unequal size; the fifth towards the broader extremity being absent.

I have thought that the name of *Spatagus* or *Spatangus,* derived from the Greek Σπάταγγος, and which is found in Aristotle and other naturalists who have thus designated this *Echinus,* ought, on this account, to be retained, although more recent writers have extended the term *Spatagus* or *Spatangus* to *all* except the oval *Echini;* and these Woodward also has followed in his catalogue, which embraces under this title all except the oval and those marked with five leaves—the pentaphylloidal shaped.

Table V, fig. 1.—The ECHINOSPATAGUS CORDIFORMIS; very common. The anal aperture which, in the entire shell, is usually closed because it is membranous, does not seem to be less minute than in the oval. I have found the shells of this genus empty, blanched, and very fragile. They are very commonly found on the shores of the Adriatic, near Pesaro, where they are termed *Cuglioni* on account of their shape and size.

Fig. 2. The base, in which may be observed both the oral aperture and the anal one of less size.

Fig. 3. The heart-shaped *Echinospatagus,* more or less flat, of a smaller size; fossil; filled with chalk rock; from, I believe, Wirtemberg. Fig. 4. The base.

Fig. 5. The heart-shaped *Echinospatagus;* fossil. English, from the Kent chalk pits. The *Echinites cordatus* of Luidius. [See Plate LXII, *Micraster cor-anguinum.*]

Fig. 6. The base. [Plate LXII, fig. 1 *b.*]

Genus VI.—*The* ECHINOBRISSUS *is an Echinus whose oral aperture usually occupies the centre of the base, but the anal is seen upon the upper surface at a short distance from the centre, and in a furrow obliquely opposite to the mouth.*

It is always of an oval shape, with the mouth invariably placed towards the narrower and the anus towards the broader part. Some species are rather more elevated, and represent in some measure the human buttocks; hence it is called *clunicularis* by Luidius:

but others with a flatter surface may be compared to a shield; hence they are termed *Echini clypeati.*

The *Brissus* (Βρίσσος) is enumerated by Aristotle in his fifth book of the 'History of Animals' as the *third* genus of *Echini.* But since his translators have not sanctioned what this naturalist understood by that term, I have applied the name of *Brissus* to this genus.

No recent *Echinobrissus* has come under my observation, but I have seen some fossil species, although these latter are by no means common. Morton assigns only one aperture to this *Echinus,* since the other situated in the furrow escaped his notice; but Woodward ought afterwards to have discovered it, since he enumerates it among the *Echini* which have two apertures, the other being in the furrow.

Table VI, fig. 1. The ECHINOBRISSUS PLANIOR or CLYPEATUS MINIMUS; fossil; filled with stony matter; with the anal aperture in the furrow. From England. [*Echinobrissus clunicularis.*]

Fig. 2. The base with the oral aperture.

Fig. 3. ECHINOBRISSUS ELATIOR; more or less raised; fossil; filled with stony matter. From England. [*Echinobrissus scutatus,* a characteristic fossil of the Coralline Oolite.]

[Plate LVI, figs. 1 and 2 represent several type forms of *Echinobrissi* from the Cretaceous formations. This genus has one living representative species.]

Genus VII.—*The* ECHINODISCUS *is an Echinus with the oral aperture situated near the centre, but with the anal between the centre and the margin or on the margin. The form always somewhat flattened.*

All the species of this genus have the likeness of a five-leaved flower upon the upper surface.

I have termed it *Echinodiscus* from the figure of a disc or orb.

As I have not seen any recent *Echinus* of the genus immediately preceding, so, on the other hand, I have never hitherto observed a fossil of this genus. The following species were all brought from the Eastern Ocean.

Table VII, fig. 1. The ECHINODISCUS CIRCINATUS MINOR, with the margin entire.

Fig. 2. The base or lower portion, in which is seen the anal aperture, but the other (the oral) in the middle is not visible on account of the mutilation of the shell in the centre.

Fig. 3. *Echinodiscus,* one half of the circumference generally marked with equal indentations.

Fig. 4. The base, in which are seen the oral and anal apertures."

"Fig. 5. All *Echinodiscus,* one half of the circumference marked with unequal indentations. The other half furnished with two pervious apertures.

Fig. 6. The base, with mouth and anus.

Fig. 7. The Echinodiscus maximus, with margin entire. The anal aperture placed on the margin itself. From the Kleinian Museum.

Fig. 8. The base, with the oral aperture in the centre.

A new genus may not inaptly be constituted as the eighth in order in my 'System,' from this last species, since it differs as to the rule of the position of the anal aperture, and in the absence of the representation of the flower. But since only this single species has been known hitherto, I have preferred adding it to the *Echinodisci,* until perchance some other specimen shall have been discovered."

[I must refer all interested in the study of this group to Professor L. Agassiz's admirable Monograph 'Des Scutelles,' with magnificent plates of living and fossil forms. T. W.]

VI. *Family*—Echinoconidæ, *Wright,* 1854.

When I proposed the establishment of this Family I defined it as a natural group of fossil *Echinoidea* having a thin, circular, or slightly pentagonal test; the upper surface in most of the forms being very much elevated or conoidal, in others it is more or less depressed.

The ambulacral areas are narrow and the inter-ambulacral wide; the plates of both are covered with numerous, small, perforated tubercles, raised on bosses with crenulated summits. They are sometimes scattered over the plate, but are frequently arranged in regular longitudinal rows. They are always larger at the base than on the sides and dorsum; and the surface of the test is likewise covered with close-set microscopic granules.

The poriferous zones are narrow, and formed throughout of round unigeminal pores about equal in diameter; they converge in a straight line from the apical disc to the peristome, around which aperture they have sometimes a bigeminal arrangement.

The mouth-opening is inferior, central, sub-circular, and armed with five pairs of jaws; the peristome is more or less decagonal and divided by notches into ten lobes, well marked in *Pygaster* and *Holectypus,* but feebly in *Discoidea* and *Echinoconus.*

The vent is variable in position; it is situated at the upper surface in *Pygaster,* at the border in *Echinoconus,* at the base in *Discoidea;* and this aperture is oval, pyriform, or oblique in different genera.

The apical disc occupies the summit of the upper surface, and is composed of five ovarial and five ocular plates; the madreporiform body is very large, extending from the right antero-lateral ovarial into the centre of the disc.

The posterior ovarial is often replaced by a complementary, imperforate plate, which is sometimes wanting altogether.

The spines are small, short, and subulate.

The ECHINOCONIDÆ are distinguished from the ECHINOBRISSIDÆ, ECHINOLAMPIDÆ, and CLYPEASTERIDÆ, by their simple poriferous zones; in this respect the family resembles the ECHINONIDÆ, from which, however, it differs in possessing a peristome furnished with auricles and a masticating apparatus; the form is likewise more circular and elevated, and the tubercles are more developed and arranged in longitudinal rows.

The ECHINOCONIDÆ are an extinct family, found only in the Oolitic and Cretaceous rocks; at present we recognise six well-defined genera in this natural group, which present the following opposite characters:

Test elevated; ambitus with projecting internal septa; vent inferior always	DISCOIDEA.
Test elevated; peristome sub-decagonal; vent marginal .	ECHINOCONUS.
Test depressed; ambitus without internal septa; vent inferior and marginal	HOLECTYPUS.
Test depressed; peristome decagonal; vent oblique, distant from the disc; tubercles perforated and crenulated . .	ANORTHOPYGUS.
Test depressed; peristome decagonal; vent pyriform, separated from the disc; tubercles perforated, but not crenulated; irregularly superposed pores . . .	PILEUS.
Test depressed; peristome decagonal; vent pyriform, not separated from the disc; tubercles perforated and not crenulated; pores unigeminal, regularly superposed . . .	PYGASTER.

I. *Genus*—DISCOIDEA, *Klein*, 1734.

GALERITES, pars, *Lamarck*, 1801. DISCOIDEA, *Gray*, 1834. DISCOIDEA, *Agassiz*, 1836. DISCOIDEA, *Desor*, 1842.

Test circular or subpentagonal at the border; upper surface much elevated, hemispherical; sides vertical or slightly convex; inferior surface flat, slightly concave.

Poriferous zones very narrow, and converging in a straight line from the disc to the peristome.

Tubercles very small, perforated, crenulated, and surrounded by areolæ, unequal and microscopic on the sides and upper surface; larger at the ambitus and base, and disposed there in regular concentric rows.

Mouth-opening small, circular, central; peristome decagonal, marked by slight notches.

Vent inferior, oval, sub-acuminate at both extremities, situated between the peristome and posterior border; opening covered with irregular granular plates, which are very small around the anal opening; this aperture is placed near the internal angle.

The apical disc solid, well soldered to the areal plates, and forming a slight projection above the test, having in some five perforated ovarial plates, in others four perforated ovarials, and an imperforate, complementary, single ovarial; madreporiform body resting on the larger antero-lateral, and extending into the centre of the disc; ocular plates small and well wedged into the angles of the ovarials.

From the inner surface of the inter-ambulacral plates near the poriferous zones thick shelly processes project inwards, and form internal septa, which occasion the ten characteristic impressions near the ambitus seen on the moulds of this genus.

Spines short, stout.

The *Discoidea* very much resemble *Holectypus.* Prof. Desor properly separated the latter from the former in consequence of the absence of all internal ribs from the shell of *Holectypus,* which likewise has a larger mouth-opening, the peristome deeper notched, and the vent often marginal.

A.—*Species from the Upper Greensand.*

Discoidea subuculus, *Klein,* 1734. Plate XLV, figs. 4, 5, 6.

Discoides subuculua,	*Klein.* Nat. dispositio Echinodermatum, p. 26, pl. xiv, *l, m,* 1734.
Echinites subuculus,	*Leske,* apud Klein, p. 171, pl. xiv, *l, m, n, o,* 1778.
— —	*Gmelin.* Systema Natura, p. 3183, 1789.
— —	Encyclop. méthod., Moll. et Zoophyt. Atlas, pl. 158, figs. 14, 15, 1791.
Discoidea subuculus,	*Parkinson.* Organic Remains, vol. iii, p. 21, 1811.
Echinites,	*Smith.* Strata Ident. by Organ. Foss., pl. vii, fig. 12, 1816.
Galerites rotularis,	*Lamarck.* Animaux sans Vert., t. iii, p. 21, 1811.
— —	*Deslongchamps.* Zooph., Encyl. méthod., t. ii, p. 433, 1824.
— —	*Defrance.* Galerites, Dic. Sc. Nat., t. xviii, p. 86, 1825.
Galerites subuculus,	*Goldfuss.* Petref. Germaniæ, t. i, p. 129, pl. xlix, fig. 2, 1826.
Echinoneus rotularis,	*Blainville.* Zooph., Dic. Sc. Nat., t. lx, p. 194, 1830.
Discoidea subuculus,	*Bronn.* Lethæa Geogn., p. 615, pl. xxix, fig. 19, 1835.
— rotularis,	*Agassiz.* Prodrome d'une Monogr., p. 186, 1836.

GALERITES HEMISPHÆRICUS,	*Grateloup.* Mém. les Oursins Fossiles, p. 55, 1836.
— SUBUCULUS,	*Desmoulins.* Études sur les Échinides, p. 254, 1836.
DISCOIDEA SUBUCULUS,	*Desor.* Monogr. des Galerites, p. 54, pl. vii, figs. 5—7, 1842.
— —	*Morris.* Catalogue of British Fossils, p. 52, 1843.
— —	*Agassiz* and *Desor.* Catal. rais. des Éch., Ann. Sc. Nat. 3e série, t. vii, p. 146, 1847.
— —	*A. Gras.* Oursins fossiles de l'Isère, p. 44, 1848.
— —	*Bronn.* Index Palæontologicus, p. 430, 1848.
GALERITES SUBUCULUS,	*Forbes.* Mem. Geol. Surv., Dec. 1, pl. vii, 1849.
DISCOIDEA SUBUCULUS,	*d'Orbigny.* Prod. de Pal. Strat., t. ii, p. 179, 1850.
— —	*Sorignet.* Oursins fossiles de l'Eure, p. 39, 1850.
GALERITES SUBUCULUS,	*Forbes* in Dixon's Geology of Sussex, p. 341, 1852.
DISCOIDEA SUBUCULUS,	*Forbes* in Morris's Catalogue of Brit. Fossils, 2nd ed., p. 77, 1854.
— —	*Desor.* Synop des Échinides Foss., p. 176, pl. xxiv, fig. 1, 1857.
— —	*Cotteau* and *Triger.* Échinides Foss. de la Sarthe, p. 170, pl. xxiv, fig. 12, 1859.
— —	*Cotteau.* Paléontologie Française, Ter. Crétacé, t. vii, p. 23, pl. 1009, fig. 8—16, 1864.
— —	*De Loriol.* Oursins de la Suisse, pl. xiii, fig. 15, 1873.

Diagnosis.—Test small, circular, or slightly pentagonal; upper surface inflated, more or less conical; under surface concave in the middle; ambulacra forming five prominent bands, composed of very narrow plates; poriferous zones narrow, straight, holes unigeminal in oblique pairs. Interambulacra wide, divided into three lobes by two subcentral carinæ, which rise from near the middle of the plates; miliary zone concave, depressed; tubercles small, perforated, larger at the base; on the sides there are two regular, constant, carinal rows, and eight or ten less regular and inconstant; at the base the principal tubercles are arranged in concentric lines around the peristome. Surface of all the plates covered with fine close-set granulations; mouth-opening small, sunk in the middle of a deep depression; vent infra-marginal, pyriform, midway between the peristome and border, with the apex directed inwards. Apical disc small, prominent, composed of five ovarial and five very small ocular plates.

Dimensions.—Height, seven twentieths of an inch; latitude, eleven twentieths of an inch. The relative proportion of height to breadth varies considerably in different specimens.

Description.—A figure given by Plott[1] in his 'History of Oxfordshire,' pl. viii, fig. 9, and described as "another sort of Button-stone, sent me from Teynton, which I take to be a mere production of nature, finely striated from the top, as I have seen some hair buttons, as in Fig. 9, and may therefore be called *Porpites:* except we should rather take it for a new sort of *Echinites* not yet discovered, which is wholly left to the reader's choice." Martin

[1] 'The Natural History of Oxfordshire,' ed. 1677, pl. viii, fig. 9, p. 139.

Lister[1] in his 'Hist. Animal. Angliæ' states, in reference to his fig. 20, tab. vii, which is copied from Plott, "Echinites parvulus striis capillaceis undiq; insignitus," ex D. Plott, fig. 9, tab. viii, "Juxta Teynton agri Oxoniensis inventus est."

Lang,[2] in his 'Historia Lapidum Figuratorum,' says, in reference to "Echinites, striis capillaceis à centro ad circumferentiam undique insignitus, subluteus mediocris rotundus, vertice compresso, basi ex pluribus annulis striatis sibi invicem impositis conflatà." I regard the original of Plott's figure not as an Echinite, but as a species of Coral belonging to the family CYCLOLITIDÆ, genus *Anabacia;* about Lang's figure I think there can be no doubt, the concentric ridges of the epitheca at the base afford sufficient evidence of the class ANTHOZOA to which his fossil Coral belonged. Klein's 'Naturalis Dispositio' is the first work[3] in which we find an undeniable figure of this Urchin; in tab. xiv, *l, m, n, o,* he says, "*Discoides subuculus;* Kamisol-Knopff: Discum Germanorum imitans, si versum vel supinum consideramus, *a Vertice rosaceo;* quinque seriebus geminis capillaceis et velut acu pictis; in vertice figuram rosulæ ferens." Leske,[4] in his 'Additamenta ad Kleinii Echinodermata,' observes, in reference to the figure given by Plott and Lister, "pro Echinite exhibetur; at vero quantum ex icone coniicere licet, potius Madreporites est, quam Echinites. Nam striæ capillaceæ ex centro progrediunter, ut in Madreporis, neque aliqua oris vel ani mentio fit, præterea a Plotio *Porpites* dicitur, quod ipsum nomen *Madreporis* petrefactis tribui solet. Tanquam dubium corpus, illud itaque omisi." Of Lang's figure Leske says, "mea sententia firma manet, hæc corpora non Echinitas, sed Madreporitas esse."

The figures of this Urchin given by Parkinson of English specimens, and by Brongniart of French, are very poor; and those of Bronn and Goldfuss of German forms, are not satisfactory. The first real good drawing is that given by Professor Desor in his valuable 'Monograph on the Galerites,' and since then Professor E. Forbes' beautiful plate of this species in the 'Memoirs of the Geological Survey,' decade 1, pl. vii, leaves nothing to be desired; subsequently admirable figures have been published in the 'Paléontologie Française, Terrain Crétacé,' and in the Échinides of the department of the Sarthe, by M. Cotteau.

The test is small, orbicular, or slightly pentagonal, the upper surface convex, more or less conical, and divided into five broad and five narrow segments by the poriferous zones, which radiate with mathematical accuracy from the circumference of the apical disc, which is small and prominent at the vertex. The under surface is rounded in young and concave in adult specimens, the small, circular mouth-opening lies in a deep central depression, and between it and the posterior margin is a large oblong vent.

The inter-ambulacral areas at the ambitus are nearly twice the width of the ambulacral; the dorsal surface of large specimens contains thirteen plates in each column between the apical disc and the basal angle; the length of the plate varies from the ambitus, where

1 'Historia Animalium Angliæ,' 1678, tab. vii, fig. 20, p. 220.

2 'Historia Lapidum Figuratorum Helvetiæ,' 1708, tab. 36, figs. 1, 2, p. 126.

3 'Naturalis Dispositio Echinodermatum,' 1734, tab. xiv, sec. 57, p. 26.

4 Ibid., Additamenta ad Kleinii, 1778, p. 172.

they are longest, to the apex, where they are shortest, but their vertical depth is nearly the same throughout; their surface is thickly covered with minute secondary granules placed in very regular horizontal rows (fig. 4 *g*). Each plate exhibits a more or less distinct sub-central carination, so that in many specimens the inter-ambulacral areas appear to be partitioned by two prominent ridges on each side of the line of junction of the plates. Along the carinated ridge each plate develops a larger tubercle, and these form a complete series from the base to the summit (figs. 4, *a*, *b*, *d*, *g*): between this and the median suture there are two smaller tubercles placed horizontally (fig. 4 *g*), and between the carina and the poriferous zones are two or more similar tubercles placed in two oblique series with reference to the larger central tubercles on the line of carination; consequently the primary tubercles placed between the carinated ridge and the median suture are horizontal, and those between the ridge and the zones arranged in oblique rows (fig. 4). At the ambitus the tubercles are more numerous and less regularly disposed. The basal plates resemble very much those on the upper surface; in full-grown specimens they are from six to eight in number; they are of the same vertical depth as those on the dorsal surface, and are ornamented in a like manner.

The ambulacral areas are half the width of the inter-ambulacral; the plates are numerous and narrow, four plates occupying the vertical depth of one inter-ambulacral plate (fig. 4 *g*); they are closely covered with small granulets, and each plate supports a small primary tubercle. These tubercles are so placed that they form oblique rows of twos or threes, and do not form direct vertical rows. The plates forming the ventral portion of the areas are rather larger than those on the dorsal surface (fig. 4 *c*).

The poriferous zones are straight and extremely narrow; the pores are unigeminal, and the pores of each pair are obliquely placed (fig. 4 *h*, *g*). Each inter-ambulacral column contains twenty-one plates, and each ambulacral column eighty-four, and there are one pair of pores opposite each plate; it follows that each zone contains eighty-four pairs of pores; all the primary tubercles are raised on elevated bosses in areolar spaces, and they are all perforated (figs. 4 *f*, *g*, *h*).

The apical disc is small, and makes a slight prominence at the vertex; the right antero-lateral plate is the largest, and supports a large madreporiform body (fig. 4 *e*); the single ovarian plate is imperforate, as in all its congeners. The ocular plates are very small, and closely fitted in between the ovarials.

The mouth is circular, and occupies a deep depression in the centre of the under surface; it is about one fourth the diameter of the base; the peristome is feebly decagonal, and the lobes are nearly equal (fig. 4 *c*).

The vent occupies a considerable portion of the basal region in the single inter-ambulacrum, between the peristome and the border; it is of a pyriform shape, having its small extremity directed inwards towards the mouth with a series of tubercles surrounding it (fig. 4 *c*).

Like other *Discoideæ*, moulds of the interior differ materially from the external shape

of the test in exhibiting ten notches around the margin, extending to the mouth on the ventral surface, and disappearing at the lower third of the dorsal. Five of these unite near the mouth, and five continue singly to it. The centre of the prominent interspaces of the latter is marked by a shallow depression. This groove corresponds to the line of suture of the ambulacral plates, and its prominent sides to the pores. The ten deep notches are caused by as many internal ribs, which spring from the inner sides of the mouth, and run up the wall under the carinated portion of each series of inter-ambulacral plates."—*Forbes.*

Affinities and Differences.—After a careful comparison of *D. subuculus* with the four following allied species, the late Professor Forbes remarks :[1]—The first, *Discoidea minima*, Agass., founded on a single example from the Chalk-marl of France, appears to be only one of the less conical forms of the young of the species, such as not uncommonly occur at Warminster. The second, *D. pisum*, Merian, is said to be exactly like *D. minima*, and only distinguishable from it and *D. subuculus* by having distinctly perforate primary tubercles; this, however, is a generic and not a specific character. The third, *D. turrita*, Desor, is proportionally higher than *D. subuculus*. The fourth, *D. infera*, Desor, has primary tubercles only at the base. I have little doubt, the Professor observes, that the several so-called species just enumerated are only slight varieties, if as much, of *D. subuculus*. M. Cotteau admits that *D. pisum* may be the young of *D. subuculus*, but that the three others indicated by Professor Forbes are certainly distinct. *D. subuculus* differs from *D. Dixoni*, Forb., in having smaller mouth- and vent-openings, so that the appearance of the base is materially different.

Locality and Stratigraphical Position.—This Urchin is abundant in the Upper Greensand of Warminster, and Chute Farm, Wilts; in the junction beds of Greensand and Chalk-marl at Maiden Bradley, Wilts; the Lower Chalk at Weymouth, and the Grey Chalk near Folkestone. This species is very abundant in the different type localities of the Étage Cénomanien in France, see p. 189.

B.—*Species from the Lower Chalk.*

Discoidea cylindrica, *Lamarck's* sp. Pl. XLVI, figs. 1, 2; Pl. XLVII, figs. 1—3.

Galerites cylindricus,	*Lamarck.* Animaux sans Vertèbres, tom. iii, p. 23, 1816.
— —	*Deslongchamps.* Encycl. Méthod., Zoophytes, t. ii, p. 433, 1824.
Conulus Hawkinsii,	*Mantell.* Geol. Trans., new series, vol. iii, part I, p. 208, 1828.
Galerites canaliculatus,	*Goldfuss.* Petrefacta Germaniæ, vol. i, p. 128, pl. xli, 1829.

[1] 'Memoirs of the Geological Survey,' Decade 1, pl. vii, p. 4.

Scutella depressa,	*Woodward.* Geology of Norfolk, p. 52, pl. v, fig. 4, 1833.
— hemispherica,	*Woodward.* Idem, pl. v, fig. 5, 1833.
Discoidea canaliculata,	*Agassiz.* Prodrome, Mém. Sc. Nat. Neuchatel, t. i, p. 186, 1836.
Galerites Hawkinsii,	*Desmoulins.* Études sur les Échinides, p. 254, 1837.
Discoidea cylindrica,	*Agassiz.* Échinid. foss. de la Suisse, Part I, p. 92, pl. vi, figs. 13—15, 1839.
Galerites cylindricus,	*Dujardin.* Animaux sans Vertèbres 2e ed., t. iii, p. 311, 1840.
Discoidea cylindrica,	*Desor.* Monographie des Galerites, pl. viii, figs. 8—16, p. 58, 1840.
— —	*Morris.* Catalogue of British Fossils, p. 52, 1843.
— hemisphærica,	*Morris.* Idem.
— cylindrica,	*Agassiz* et *Desor.* Catal. rais. les Éch. An Sc. Nat. 3e ser., t. vii, p. 147, 1847.
— —	*Bronn.* Index Palæontologicus, p. 429, 1848.
Galerites (discoidea) cylindricus,	*Forbes.* Mem. of Geol. Surv., Decade 1, pl. viii, 1849.
Discoidea cylindrica,	*d'Orbigny.* Prod. de Pal. strat., t. ii, p. 178, 1850.
Galerites cylindricus,	*Quenstedt.* Hand. der Petrefact., pl. xl, fig. 20, p. 583, 1852.
Discoidea cylindrica,	*Gras.* Catal. Ours. foss. de l'Isère, p. 43, 1852.
— —	*Morris.* Catal. Brit. Foss., 2 ed., p. 77, 1854.
— —	*Pictet.* Traité de Paléont., t. iv, p. 228, pl. xcv, figs. 9—12, 1857.
— —	*Desor.* Synopsis des Échinides Fossiles, p. 177, pl. xxix, fig. 12, 1857.
— —	*Cotteau.* Paléont. Française, Ter. Cret., t. vii, p. 28, pl. 1010 et 1011, 1866.
— —	*DeLoriol.* Ours. de la Suisse, pl. xiii, fig. 14, 1873.

Diagnosis.—Test large, sub-circular, slightly pentagonal; upper surface hemispherical, more or less elevated, regularly convex above, rounded vertically on the sides, and acutely angular at the border; base nearly flat, marked by impressions which correspond to the internal carina; ambulacra one third the width of inter-ambulacra; mouth-opening central, decagonal; vent small, oblong, basal, midway between the peristome and border.

Dimensions.—A. Height, one inch and four tenths; latitude, two inches and one tenth.

B. Height, one inch and eight tenths; latitude, two inches and two tenths.

Description.—Whether this common Chalk Urchin was known to Leske or not is difficult to decide. My friend Professor Desor considers the notice on *Echinus quater-fasciatus* to refer to this species; but a careful examination of Leske's figures leads me to the conclusion that the mouth figured by that author in his Pl. xlvii represents some species of the genus *Echinoconus* rather than a *Discoidea,* for they show no trace of

impressions made by the internal ribs, so characteristic of the latter genus. For this reason I am of opinion that the history of this Urchin commences with Lamarck's description.

The outline of *Discoidea cylindrica* is orbicular, the base is very flat, and the upper surface convex, more or less elevated, the amount varying with its phases of growth from a regularly hemispherical form in young shells, as in the specimen figured in Pl. XLVI, fig. 2 *a*, to hemispherico-cylindrical, its adult condition, as shown in Pl. XLVI, fig. 1 *c*, and Pl. XLVII, fig. 1 *a*, *b*.

The inter-ambulacral areas are three times the width of the ambulacral (fig. 1 *a*, *b*, *d*); the plates on the sides and lower part of the dorsal surface are broad horizontally and narrow vertically (fig. 1 *d*), and those around the vertex are nearly square (fig. 1 *e*); near the middle of each plate there is a slight elevation of the surface which, in connection with others in the column of plates, form a line of carination, which extends from the apical disc to the circumference, and imparts a marked feature to some old tests (Pl. XLVII, fig. 1). On this ridge a tubercle rather larger than the others is developed (fig. 1 *d*) on the lower half of each plate; (this tubercle with the line of carination is indicated in fig. 1 *d* by the vertical shading). On the surface of each plate from the sides of the test there are from six to seven larger, and the same number of smaller tubercles (fig. 1 *d*), all of which are perforated and striated, and their areolar spaces surrounded by circles of minute granules (fig. 2 *d*); the quadrate plates in the upper portion of the columns support only the one tubercle growing on the line of carinations already referred to (fig. 1 *e*). In addition to the perforated and striated tubercles, the plates are covered with microscopic granules, distributed very regularly over the surface. The series of plates around the angular border are narrow, and bear five or six large tubercles arranged in regular horizontal rows, having areolar excavations around their base. Those on the basal plates are still more conspicuously ornamented with rows of primary tubercles, each surrounded by a depressed areola bounded by granules, which are larger and more thickly set than on the upper surface. The plates round the mouth are smaller and have fewer tubercles (fig. 1 *b*). The inferior inter-ambulacral plates bulge out on each half near the margin, a prominence which is continuous with the lines of carination above, and indicates the position of the internal ribs in the interior of the test. Pl. XLVII, fig. 2 *a*, *b*, shows the position of impressions made by the internal ribs on a well-marked mould; from this we learn that the two impressions at the base of each inter-ambulacra, and the ridge at the circumference, are due in part to the internal ribs of the test.

The ambulacral areas are narrow and lanceolate above, and of the same width and more prominent at the base; they are composed of small unequal plates, of which about three correspond vertically to one inter-ambulacral plate. They are, however, very irregular in size and shape, some being narrow, others rhomboidal or triangular, with small wedge-shaped pieces fitted into the poriferous zones, the whole forming a kind of mosaic of many-sized pieces. The plates at the base and on the upper surface are more regular in form and smaller in size than those on the sides (fig. 1 *d*); each plate carries

one or two small primary tubercles; at every third plate one of these is near the zonal side (fig. 2 *f*), so that in each ambulacra there are two marginal rows of small perforated and crenulated tubercles surrounded by several microscopic granules.

The poriferous zones are very narrow, and have one pair of small round holes opposite each ambulacral plate, which are larger and more conspicuous on the dorsal than on the ventral surface; on the lateral and dorsal surfaces the pores are unigeminal, but at the base, from the narrowness of the plates, they fall into double file (fig. 2 *f*), and near the mouth-opening two rows go to each plate, the number of pairs of pores corresponding with the number of the ambulacral plates; taking the average as equal to seven ambulacral plates for two inter-ambulacral an average-sized adult test would have seventy pairs of pores in the lateral and dorsal portions of the zones; the exact number at the base it would be difficult to estimate, from the narrowness of the plates and the bigeminal arrangement of the pores.

The base is flat and the mouth-opening occupies the centre of the disc; it is a small obscurely decagonal opening (Pl. XLVI, figs. 1 *b*, 2 *b*), equal in diameter to one fourth the distance between it and the border; the peristome is subcircular and divided into ten equal lobes; it is only in some rare specimens that this part of the anatomy of the test is shown, as the oral opening is nearly always filled with closely adhering matrix. In some fine specimens from the soft Grey Chalk I have been able to clear out the peristome and demonstrate the oral lobes.

The vent is proportionately very small, oblong, and acute at each extremity. It occupies rather more than one fourth of the space between the mouth and border, and is distant from the margin about its own long diameter (fig. 1 *b*). The plates of the single inter-ambulacrum appear sharply incised by the vent, the margins of which are on a level with them except at the inner extremity, where there is a bulging of the plates extending to the peristome (Pl. XLVII, fig. 1 *b*).

The apical disc is well shown in my type-specimen; and this structure is accurately drawn in Pl. XLVI, fig. 2 *c*. It is often prominent in consequence of the convexity of its elements; the five ovarial plates are of an irregular rhomboidal figure and closely united together; four of the five plates are perforated for the passage of the genital tubes, the single plate is imperforate, and the microscopic madreporiform body occupies the entire surface of the right antero-lateral plate. The five ocular plates, each having an orbit, are small cordate bodies wedged into the angles of the ovarials, fig. 2 *c* shows this structure magnified six diameters. Mr. Bones' very accurate drawing renders any lengthened description of the discal elements unnecessary.

In Pl. XLVII, fig. 2 *a*, *b*, I have figured a very perfect mould of this Urchin to assist the geologist to identify the species when all the test is absent. This mould is marked by ten impressions made by the internal carinæ of the test, which deeply groove the border and base and extend from the lower part of the sides, pass along the floor of the test and vanish at the peristome. In addition to these well-marked depressions Professor

Desor describes and figures three fine marginal incisions visible below and in profile in each column of plates, and which assume a different form in the single inter-ambulacrum where they are only two in each column; they are here wider and deeper than those in the pairs of the inter-ambulacra.

Pl. XLVII, fig. 3, is the drawing of the base of a mould of a monstrosity of this species, in which there are only four ambulacra seen from below.

Affinities and Differences.—*Discoidea cylindrica* cannot be mistaken for any of its congeners, as it is readily identified by its great height, its inflated and sub-cylindrical form, its perfectly flat base, and by the proportionate smallness of the oral opening and the vent. *Discoidea Favrina* is the nearest allied form; this, however, differs from *D. cylindrica* in having a larger vent placed nearer the border, and in having the inter-ambulacral plates much larger; each plate, in vertical height, corresponding to six ambulacral plates.

Locality and Stratigraphical Position.—This species occurs in the Upper Chalk of Norwich and Holt (Mr. S. Woodward, Sen.), Chalk Marl and Lower Chalk at Hamsey, near Guildford, Markham Gayton, Charing, Lewes, Dover, Burham, near Maidstone, Speeton, Yorkshire; the Chloritic Marl, near Chardstock, and in the Red Chalk, in the highest of the tinted bands at Speeton Cliff, Yorkshire, at the part where the pink and white sems alternate (Rev. T. Wiltshire).

Foreign Distribution.—In France, in the 'Étage Cénomanien,' according to M. Cotteau, Rouen (Seine-Inférieure); Pourrain, Saint-Sauveur (Yonne); La Fauge près le Villard-de-Lans (Isère); Saint-Aignan en Vercors (Drôme); Castellanne (Basses-Alpes). In Germany, in the Lower Pläner (stage with *Ammonites Rhotomagensis*) = Chalk-marl of English authors; at Langelsheim near Brunswick (Strombeck); at Rethen, near Hildesheim (Römer), near Paderborn (Goldfuss), from the Gault of the Mountain of Fis, according to Desor, and from the Étage Albien, Cheville, Alpes Vaudoises = Lower Chalk (Renevier).

Discoidea minima, *Agassiz*, 1840. Pl. XLVII, fig. 4 *a—h*.

Discoidea minima, *Agassiz*. Catal. Syst. Ectyp. Foss., p. 7, 1840.
— — *Desor*. Monogr. des Galérites, p. 56, pl. viii, figs. 1—4, 1842.
— — *Morris*. Catalogue of British Fossils, p. 52, 1843.
— — *Agassiz* and *Desor*. Catal. raisonné des Échinides, 1847.
— — *Morris*. Catalogue of British Fossils, p. 77, 2nd ed., 1854.
— — *McCoy*. Contributions to British Palæontology, p. 67, 1854.
— — *Cotteau*. Paléontol. Française, t. vii, pl. 1012, figs. 1—7, 1866.

Diagnosis.—Test small, sub-circular; height and length equal; upper surface inflated; base slightly convex; border round; ambulacra half the width of the inter-ambulacra; tubercles form regular series on the sides of the areas; mouth and vent moderately wide.

Description.—The specimens of this Urchin sent to me for drawing and description were so imperfect that I requested Mr. Bone to make accurate copies of the very capital figures of this species given by my friend M. Cotteau in the 'Paléontologie Française,' pl. 1012, figs. 1—7.

The test is small and sub-circular; the upper surface inflated and convex; the base slightly swollen in the middle, and round at the border.

The ambulacra half the width of the inter-ambulacra, with two rows of primary tubercles extending from the disc to the peristome (fig. 4 *g*, *h*); the plates supporting, besides, numerous fine granules, which are disposed around the base of the tubercles. The poriferous zones are narrow, the pores round, unigeminal, slightly oblique, and well spaced out from each other (fig. 4 *f* and fig. 4 *g*).

The inter-ambulacra are formed of large plates; at the ambitus each plate carries three tubercles, two of which are more conspicuous and persistent than the others, and reach higher up the sides. The central tubercles extend from the disc to the peristome, and the zonal series is absent above and below; the larger tubercles grow on two slightly elevated longitudinal carinal lines (fig. 4 *f*), indicated by the direction of the shading in the figures. The granulations on the plates are very fine and form horizontal beaded chains of great delicacy; the primary tubercles at their base have circular depressed areolas without encircling granulations.

The small mouth-opening has a circular or sub-decagonal peristome and opens in the centre of the base, which is slightly convex (fig. 4 *a*).

The vent is oval, and acuminated at the inner extremity; it occupies nearly two thirds of the space between the peristome and posterior border; the aperture was closed by a series of ten anal plates, unequal in size (fig. 4 *h*) and covered with small granules; the periprocte at the inner border is surrounded by seven small plates let into a space around the vent like a piece of mosaic.

The apical disc is small and composed of five perforated ovarial plates, the right antero-lateral being much the largest and covered with the madreporiform body; the surface of the other four is crowded with granules; and the small cordate oculars are wedged into the angles formed by the ovarial plates.

Affinities and Differences.—The general form and arrangement of the tubercles on *D. minima* resemble the young condition of *D. subuculus*, of which some authors consider it a small variety. M. Cotteau[1] has had an opportunity of examining with care a great number of specimens collected from different localities, and says that he has acquired the certainty that this species differs essentially from *D. subuculus*, not only in its size, which is constantly smaller, but in its greater height, more inflated sides, and convex base, and by its granules, which are more closely set together and disposed in more regular lines on the plates, and always by its apical disc, which is composed of five perforated ovarial plates.

[1] 'Paléontologie Française,' tome vii, p. 35.

Locality and Stratigraphical Position.—This species is extremely rare; on the authority of Professor M'Coy one only has been found in England in the Upper Greensand of Cambridge; and this type-specimen, with its anal plates, is in the Woodwardian Museum of Cambridge.

The Foreign Localities, according to M. Cotteau, are Rouen (Seine-Inférieure), Neuchâtel près Boulogne (Pas-de-Calais); Verronnet (Eure); La Chapelle Saint-Aubin, Les Menus près la Loupe (Sarthe); environs de Villedieu (Loir-et-Cher), from the Étage Turonien, where it is very rare.

DISCOIDEA FAVRINA, *Desor*, 1842, Pl. XLVIII, fig. 1 *a—g*.

DISCOIDEA FAVRINA, *Desor*. Monogr. des Galerites, p. 62, pl. vii, figs. 12—16, 1842.
— — *Forbes*. Mem. of Geol. Survey, Decade I, descrip. pl. viii, 1849.

Diagnosis.—Test sub-pentagonal; upper surface elevated, round, more or less inflated; base flat; mouth-opening small; vent oblong, midway between the peristome and border; inter-ambulacra wide, two prominent rows of primary tubercles; ambulacra narrow; five plates opposite one inter-ambulacral.

Dimensions.—Height seven tenths of an inch; latitude one inch.

Description.—This Urchin was first figured by my friend Professor Desor under the name *Discoidea rotula;* he informs us that when the plates were executed for his beautiful memoir on the *Galeritidæ* his knowledge of the *D. rotula* was limited to moulds of this species, or to moulds with a fragment of the test adherent, but so much effaced that it was impossible to study its intimate structure. As he had recognised among the Urchins sent to M. Agassiz by M. Alex. Brongniart from the "Glauconie" of Rouen, who had first figured *D. rotula*, a species very similar in form to the others, he thought he could identify it with *D. rotula;* subsequently M. Favre, of Geneva, sent from Saxonnet a specimen of *D. rotula* with its test perfectly preserved. This specimen he compared with those sent from Rouen, when he found that the tubercles on *D. rotula* from Saxonnet were very different from those on the specimens from Rouen, for instead of being scattered without apparent order on the surface of the test, they formed horizontal series very continuous, resembling those on *D. macropyga*. This discovery determined M. Desor to separate the Saxonnet specimen from those derived from the "Glauconie" of Rouen, and to describe it under the name *Discoidea Favrina*.

The specimen I have figured from the British Museum collection was identified by the late Dr. Woodward as the representative of Desor's species from the Upper Greensand; the test has a subpentagonal outline, is considerably elevated with a convex dorsal surface

(fig. 1 *c*); the base is flat; the mouth-opening small (fig. 1 *b*, and the oblong vent occupies a space midway between the peristome and the border.

The ambulacral areas are formed of small irregular-shaped plates, many of a triangular form. On each of these is a primary tubercle, so placed that on every three plates we observe an oblique disposition like this . : ˙ The poriferous zones are very narrow, and there is one pair of pores opposite each of the ambulacral plates, of which five are packed within the vertical depth of one inter-ambulacral. Fig. 1 *e* shows the structure of one of these areas magnified four diameters, and the form of the individual plates is well delineated in this drawing.

The inter-ambulacral areas are four times the width of the ambulacral; the tubercles are arranged with much regularity, and two series in each area, situated about one third the distance between the zones and the median sutures, are formed of larger primary tubercles, which are elevated on a slight carinal ridge of the plate, and extend uninterruptedly from the apical disc to the peristome; this ridge is faintly represented by a vertical line in fig. 1 *e;* besides the longitudinal series there are several other tubercles very regularly arranged, and between them the surface of the plates is covered with a microscopic granulation. The tubercles are larger at the base, and form horizontal rows on the plates (fig. 1 *g*), where several of the basal plates are drawn four diameters to show this arrangement of the tubercles with their encircling granules. The structure of the basal portion of the single inter-ambulacrum with the oblong vent is well shown in fig. 1 *f*, where the two primary series of tubercles flank the periprocte, and others fill up the intermediate spaces; in this figure, likewise magnified four diameters, we observe that each alternate plate of the basal portion of the ambulacra supports a primary tubercle.

The apical disc (fig. 1 *d*) is formed of five irregular, pear-shaped ovarial plates, four of which are perforated; the right antero-lateral is larger than the others, and supports as usual the madreporiform body. The five heart-shaped oculars with their microscopic orbits are wedged between the ovarials; the elements of the disc are well soldered together and form a compact body.

The mouth-opening is small, and occupies a slight central depression (fig. 1 *b*).

Affinities and Differences.—This Urchin closely resembles *D. cylindrica*, a species which presents many interesting varieties of size and form from different localities, scarcely two specimens from the Grey Chalk of Folkestone, or the Lower Chalk of the South of England, being precisely alike. The same remark may be made of the specimens of *D. cylindrica* now before me from the Pläner of Hanover, the Craie Chlorité of La Fauge (Isère), and the Étage Cénomanien of Saint-Aignan (Drôme), and of other departments of France; such being the case I accept *D. Favrina* only as a provisional species until a series of specimens have been found which may determine more accurately its specific characters.

Locality and Stratigraphical Position.—The specimen I have figured belongs to the

British Museum, and was obtained from the Upper Greensand. Professor Desor's type was collected by Professor Favre from the same stage at Saxonnet. My late colleague, Professor Forbes, stated in his note on allied British species of *D. cylindrica:* "I think it not improbable that in the end we shall have to adopt the specific appellation *Favrina* for the Greensand species; and that the Chalk specimens alluded to will prove varieties of *cylindrica;* but a comparison of the types themselves only can settle the matter." 'Memoirs of the Geological Survey, British Organic Remains,' Decade i; note to plate viii, *Discoidea cylindrica.*

DISCOIDEA DIXONI, *Forbes*, 1850. Pl. XLVIII, fig. 2 *a—d*, fig. 3 *a, b*.

DISCOIDEA DIXONI, *Forbes*, in Dixon's Geology of Sussex, pl. xxiv, figs. 13, 14, 1850.
— — *Forbes*, in Morris's Catal. of British Fossils, 2nd ed., p. 77, 1854.

Diagnosis.—Test small, circular; upper surface elevated, dorsum convex, sides inflated; base slightly convex; mouth-opening and vent very small; inter-ambulacra wide; two rows of primary tubercles more prominent than the others; surface of the plates finely granulated; basal tubercles larger; apical disc small; the five genital plates all perforated.

Dimensions.—Height five twentieths of an inch; latitude three tenths of an inch.

Description.—In describing this Urchin, which he found in Mr. Frederick Dixon's 'Cretaceous Fossils from Sussex,' my late colleague, Professor Edward Forbes, observes: "In form and size this species resembles *Discoidea subuculus;* also in the proportional number of ambulacral as compared with the inter-ambulacral plates, and the granulation of their surfaces. It is distinguished, however, by the proportions and dimensions of mouth and anus as compared with the whole ventral surface. The mouth, instead of being (as in *subuculus*) nearly equal in diameter to the distances between its sides and the margin of the inferior surface, is scarcely half that size, and the anus, instead of occupying the greater part of the space between the mouth and the margin, fills less than half of it."[1]

This elegant little Urchin has likewise the upper surface elevated, the sides inflated, and the base slightly convex, a careful comparison of type-specimens discloses the affinities and differences subsisting between these congeneric forms.

The ambulacral areas, half the width of the inter-ambulacral, have a row of small tubercles on the zonal side of the plates, one tubercle on every other plate in the column, and a second row more irregular than the former, filling in only the wider part of the area

[1] 'Dixon's Geology and Fossils of Sussex,' p. 341.

(fig. 2 *d*); the surface of the plates is likewise covered with numerous microscopic granules set in horizontal rows. There are four ambulacral plates opposite each inter-ambulacral, and a pair of oblique pores correspond to each ambulacral plate.

The inter-ambulacral areas have two rows of primary tubercles, nearer the zonal than the sutural side of the plates; these rows extend from the disc to the peristome (fig. 2 *a*, *b*, and fig. 3 *a*); each plate besides, near the ambitus, supports four smaller tubercles placed less regular on the surface than those forming the vertical series. The surface of the plates is likewise covered with a most abundant development of microscopic granules arranged in horizontal rows in the direction of the long diameter of the plate. Fig. 2 *d* shows this condition of the surface in the plates of both areas magnified six times; all the tubercles are perforated and crenulated. Those on the base are large as shown in fig. 3 *a*, where the test is magnified twice; and the details of a portion of the same are very well exhibited in fig. 3 *b*, where a portion of both areas is accurately drawn eight times the natural size. These admirable drawings by my friend Mr. C. R. Bone render any detailed description unnecessary, as they are correct representations of the minute anatomy of the test carefully drawn under a lens.

The apical disc is level with the general surface, and all the five ovarial plates are perforated (fig. 2 *c*), as in *D. minima*.

The base is slightly convex; the small mouth-opening is quite superficial, and its peristome is marked with microscopic incisions; the vent is oblong, and occupies the middle of the space between the peristome and border, which is rounded and inflated, but never angular as in *D. subuculus*.

Affinities and Differences.—When compared with *D. subuculus* it is distinguished by the proportions and dimensions of mouth and vent as compared with the whole ventral area, which are much larger in *D. subuculus* than in *D. Dixoni*. M. Cotteau is inclined to unite *D. Dixoni* to *D. minima*, as the apical disc in both has each of the five genital plates perforated, whereas, in other congeneric forms, only four of the ovarials are so.

Locality and Stratigraphical Position.—The type-specimen was collected from the White Chalk of Sussex, and the original of our figures belongs to the British Museum.

Genus—Echinoconus, *Breynius*, 1732.

Conulus, *Klein*, 1734. Echinites, *Leske*, 1778. Galerites, *Lamarck*, 1801.

Shell round, oval, or pentagonal; enlarged a little before and slightly contracted behind; upper surface more or less elevated, and having a rounded or conoidal form; summit central; under surface flat, border rounded or angular, sometimes concave in the middle, rarely undulated by the depression of the ambulacra.

Mouth-opening small, circular, decagonal, in the centre of the base; peristome

notched with internal auricles, and supporting a pentagonal masticating apparatus; vent oval, acuminated above, opening on the border, either marginal or infra-marginal.

Ambulacra lanceolate; poriferous zones narrow; pores unigeminal, except near the peristome, where they are trigeminal.

Inter-ambulacra wide, with numerous primary tubercles, small on the sides and upper surface, and larger at the base; in both crenulated and perforated; miliary granules either microscopic and homogeneous, filling up all the intermediate spaces, or larger and more developed, and disposed in regular circles around the primary tubercles.

The apical disc, placed at the centre of the summit, is quadrangular, solid, and compact, and composed of four perforate and one imperforate ovarial plates; the right antero-lateral is much the largest, and is prolonged posteriorly with a portion of the madreporiform body into the centre of the disc; the three other plates are much smaller, and terminate externally in prominent angles, in which the genital aperture is pierced. The five ocular plates are very small, and interposed between the angles of the ovarials.

The genus *Echinoconus* is distinguished from *Discoidea* by the position of the vent, and the absence of projecting processes from the interior of the test; from *Pygaster* by its infra-marginal vent, absence of a dorsal aperture, and its elevated conoidal test; from *Holectypus* by its elevated profile and much smaller mouth- and vent-openings; from *Pyrina* in the quadrangular structure of the apical disc, its more pentagonal and conoidal form and regular decagonal peristome provided with five jaws, and by its infra-marginal vent.

In Professor Desor's valuable Monograph on the Galerites twelve species are beautifully and accurately figured belonging to the genus *Echinoconus*, such as I have defined it; after a careful study of this series, and a comparison with a collection of specimens of many varieties now before me, I have come to the conclusion that they all are referable to four types, each of which may be described as a distinct species. These are—

1st. *E. castanea.*—Has an oblong form, enlarged anteriorly and contracted posteriorly; the upper surface depressed; it belongs to the Upper Greensand, the Chalk-marl, and Lower Chalk.

2nd. *E. sub-rotundus.*—Has a tall, round, or sub-globular test, and appears to be one of the many forms which were figured by Klein and described by Leske under the name *Echinites vulgaris;* the specimens grouped together were siliceous moulds, entirely destitute of shell, and clearly referable to several specific forms; one of them may represent the beautiful test I have figured; but as it is impossible to determine its identity, I prefer retaining the appropriate name given to it by Mantell. This species is collected from the Lower Chalk of Sussex, and several of my specimens came from Lewes.

3rd. *E. conicus.*—This is the true ECHINOCONUS VERE CONICUS; *marino-terrestris, creta repletus; ex cretæ fodinis Cantianis,* of Breynius; two years later Klein named it *Conulus albogalerus* on account of its fancied resemblance to the white caps worn by the priests of Jupiter; it has been frequently figured (see the synonyms of this species) and

described under that name; there never was any mistake about the typical form of this species; although its generic and specific names have been frequently changed; in justice to its original author I have restored its old name. It appertains to the Medial Chalk.

4th. *E. abbreviatus.*—This species was proposed by Lamarck for a large flint mould figured by Leske; but whether that form is the prototype of the Urchin to which I now apply the name is uncertain, for moulds seldom possess specific characters and ought never to have been described and figured as representatives of species; moulds having been so admitted by former authors have led to interminable confusion, and *E. abbreviatus* is one of many examples that might be adduced of this error. My learned friend, Professor Desor, in his valuable Monograph, has cited thirty-one references to *Galerites abbreviata,* Lamk., and given excellent figures of one of the varieties, which is the *G. vulgaris* of Goldfuss and Bronn. The first figure that can be relied upon as truly representing *E. abbreviatus,* Desor, is that given in Woodward's 'Geology of Norfolk,' pl. v, figs. 2 and 3, p. 47, where it is entered in his stratigraphical list of fossils as *G. vulgaris,* I have a series of type-specimens of this Urchin from the same chalk pits, and have ascertained the accuracy of this identification; we next find that *G. vulgaris,* Woodward, is *G. angulosa,* Desor, pl. iv, figs. 5—7, and *Caratomus hemisphæricus,* Desor, pl. v, figs. 14—19; both these species were drawn and described from English specimens collected from the White Chalk of Norwich, and sent by the Marquis of Northampton to Professor Agassiz, so that there can be no mistake about the identity of the original specimens most beautifully and accurately figured in Desor's valuable work.

A.—*Species from the Lower Chalk.*

Echinoconus castanea, *Brongniart,* 1822. Pl. LI, fig. 2 *a—g*, fig. 3.

Nucleolites castanea,	*Brongniart.* Géol. Environs Paris, pl. Q, figs. 13, 14, 1822.
— —	*Defrance.* Dict. Sc. Nat., tome 35, p. 214, 1825.
Galerites castanea,	*Agassiz.* Échinod. Foss. Suisse, pl. xii, fig. 7—9, p. 77, 1839.
Catopygus castanea,	*Agassiz.* Prodrome des Échinides, p. 185, 1835.
Pyrina castanea,	*Desmoulins.* Études Échinides, p. 185, 1837.
Galerites Rothomagensis,	*Agassiz.* Cat. Syst. Ectyp., p. 7.
— castanea,	*Desor.* Monogr. des Galerites, pl. iv, figs. 12—16, p. 23, 1842.
— —	*Agassiz* and *Desor.* Catal. rais. des Échinides, Ann. Sc. Nat., 3rd series, vol. vii, p. 149, 1847.
— —	*Morris.* Catalogue of British Fossils, p. 80, 1854.
— —	*Forbes.* Mem. Geol. Surv., Decade iii, pl. vii, 1850.
Echinoconus castanea,	*d'Orbigny.* Revue de Zool., p. 21, 1854.
Galerites Rothomagensis,	*Sismonda.* Échin. Foss. de Nizza p. 51, pl. 2, figs. 8—10, 1843.
Echinoconus castanea,	*Cotteau.* Paléontol. Française, t. vi, p. 503, pl. 990.
— —	*De Loriol.* Ours. de la Suisse, pl. xiv, fig. 1, 1873.

Diagnosis.—Test oval, pentagonal, enlarged anteriorly, contracted and rounded posteriorly; upper surface elevated and convex; sides inflated; base contracted, slightly convex or flat. Mouth-opening small, roundish, and central; vent large, elliptical, marginal; ambulacra narrow, prominent, corresponding to the angles of the test. Poriferous zones linear, pores unigeminal; apical disc small, central, soldered to the plates of the test.

Dimensions.—The following measurement of six specimens is given to show the variability of the proportions of this species.

	A.	B.	C.	D.	E.	F.
	G. C.	G. C.	G. C.	U. G.	C. M.	C. M.
Length .	2	$1\frac{6}{10}$	$1\frac{1}{10}$	$1\frac{1}{10}$	1	$\frac{9}{10}$
Breadth .	$1\frac{8}{10}$	$1\frac{4}{10}$	$1\frac{1}{10}$	1	$\frac{9}{10}$	$\frac{9}{10}$
Height .	$1\frac{2}{10}$	$1\frac{3}{20}$	$\frac{17}{20}$	$\frac{9}{10}$	$\frac{7}{10}$	$\frac{6}{10}$

G. C. means Gritty Chalk; U. G. Upper Greensand; C. M. Chloritic Marl; and the measurements are in inches and parts of an inch.

Description.—The two Urchins, from the cretaceous rocks of Savoy, drawn in pl. Q, figs. 14 and 17, of M. Alex. Brongniart's 'Description Géologique des Environs de Paris,' and described under the names *Nucleolites castanea*, Al. Br., fig. 14, and *Nucleolites depressa*, Al. Br., fig. 17, have occasioned much diversity of opinion among Palæontologists in consequence of the unsatisfactory condition of the specimens themselves and the inadequacy of the figures for subsequent determination.

Having collected many specimens of this species showing its various stages of growth, I am enabled to state that the two forms figured by Brongniart are only different conditions of the same species, my larger shells agreeing with *N. castanea* and the smaller with *N. depressa.*

I have given the anatomy of the test with ample details of structure of the largest specimen I have seen from a very fine fossil in my collection (fig. 2 *a*—*g*); the smaller and commoner shell is drawn in fig. 3.

The distinctness of the two forms has been persistently maintained by most foreign authors, as our table of synonyms shows; nevertheless in this, as in other matters, authority must bend to facts, and dry anatomy settle the question of the unity of the species.

The British specimens of *Echinoconus castanea* nearly all belong to the small variety; these were collected from the Chloritic Marl near Chaldon, Dorset, and most of them have the test beautifully preserved. My larger specimens were obtained from the bed of hard gritty siliceous Chalk near Folkestone, and are equally well preserved, so that both varieties belong to the lower portion of the Cretaceous formation.

All my specimens are of an ovate or sub-globular form, inclining to a pentangular or

hexangular outline. They vary much in the degree of height and tumidity, as compared with their length and breadth; the upper surface is sometimes convex and sometimes depressed; the anterior half of the shell is more enlarged than the posterior, the widest portion being the region across the antero-lateral ambulacra (fig. 2 *b*, *d*). The obscure angles, when they are five, correspond to the ambulacral areas; when there is a sixth it is in the centre of the single inter-ambulacrum. The sides are so rounded that their most tumid portions are central or sub-central.

In the large specimen (fig. 2 *b*) the base is flat, inclining to concave, in the smaller specimens from the Chloritic Marl, as in fig. 3, the border is so rounded off at the sides that it becomes slightly convex, in the still smaller varieties it is mostly flat.

The ambulacral areas are narrow, tapering towards the disc and peristome, and widest above the ambitus (fig. 2 *a*, *b*, *c*); they are formed of narrow plates four or five of which are opposite one inter-ambulacral; four rows of tubercles set in a zig-zag arrangement occupy the area (fig. 2 *e*), and those at the base are much larger than those on the sides. The poriferous zones are linear and the very small pores are set in triple oblique pairs, six or eight pair being opposite the vertical height of one inter-ambulacral plate.

The inter-ambulacral areas, four times the width of the ambulacral, are formed of broad and well-developed plates (fig. 2 *a*, *b*, *c*); in the large specimen (fig. 2 *c*), twelve of these are found in each column between the disc and border, and six between the border and peristome; each plate supports two rows of tubercles set in irregular horizontal lines above each other, four or five tubercles occupying each row. Fig. 2 *e* shows two complete and two incomplete inter-ambulacral plates, and a portion of the ambulacral area and poriferous zones magnified four times; besides the primary tubercles the surface of the plates of both areas is covered with numerous microscopic granules. The basal have larger tubercles than the lateral plates. Fig. 2 *f* shows two of these plates from the middle of the base magnified four times; the crenulations of the boss and the perforations at the summit are better seen in this than in the other figure.

The apical disc is composed of five genital and five ocular plates; four of the former are perforated and the single plate is imperforate (fig. 2 *g*). The right antero-lateral genital plate is much the largest and supports the madreporiform body, which extends backwards and fills the central portion of the disc. The small cordate perforated oculars are wedged into the angles formed by the ovarials and complete the circle of the disc, the elements of which are well soldered together to form a compact structure; and the surface of the plates uncovered by the spongy body is studded with close-set microscopic granules.

The mouth-opening is small and oval (fig. 2 *b*), the long diameter extending obliquely across the base from the left to the right side; the peristome is obscurely decagonal and divided into ten nearly equal-sized lobes. The base is sometimes flat, or slightly concave, as in the large specimen (fig. 2 *b*), or it is flattened in the centre and rounded off at the sides, or sometimes it is slightly convex (fig. 3); in either case the mouth-opening is nearly in the middle.

The vent is elliptical (fig. 2 *d*); one third larger than the mouth in vertical dimensions; it is placed at the lower part of the posterior border in the single ambulacrum immediately below the margin (fig. 2 *b*), or just within the range of the same; it varies a little in the degree of its elevation in the different specimens I have compared.

Affinities and Differences.—This species is distinguished from its congeners by its elongated and pentagonal form; it is enlarged anteriorly and tapers slightly posteriorly, its greatest transverse diameter being across the antero-lateral ambulacra; it becomes a little narrower towards the posterior border, which is rounded with an elongated ridge rising from the upper angle of the elliptical vent. The primary tubercles of both areas are of the same size; they are sunk in areal depressions and scarcely rise above the general surface of the plates, the whole of the intermediate structure being covered with numerous close-set granules; so that the shell of *Echinoconus castanea* feels smooth to the touch when compared with that of *Echinoconus conicus* or *E. abbreviatus.* In this respect it resembles *E. subrotundus;* the latter, however, has a smoother test, with fewer and smaller tubercles on the plates; besides this character the elongated pentagonal form is very characteristic of *E. castanea.*

Locality and Stratigraphical Position.—*Echinoconus castanea* is collected very rarely in the Upper Greensand. A few specimens have been found in this formation at Chute Farm, near Warminster, and one of these now lies before me. Small forms of this Urchin in fine preservation are very characteristic of the Chloritic Marl near Chard, a bed of Chalk Marl tinged green with scattered particles of silicate of iron, which lies between the Chalk Marl and Upper Greensand, and contains a most interesting suite of *Echinidæ,* all of which likewise occur in the Upper Greensand formation. The large figured specimen was obtained from the Chalk Marl near Lewes, in Sussex. I have others that were collected from the bed of hard gritty Lower Chalk near Folkestone, a stratum which has yielded many interesting Urchins, as *Salenia granulosa, Cyphosoma simplex,* and numerous Polyzoa. It belongs, therefore, to the lower division of the Cretaceous formation.

Foreign Distribution.—It was collected by Mr. Alex. Brongniart in the Albien stage of the Chalk at the Mountain of Fis, in Savoy; in the same stage near Nice, by M. Cailliaud; in France at Escragnolles (Var), by MM. Cotteau and Kœchlin; near Près, Valley de Rencurel, near Grenoble (Isère), by M. Albin Gras.

Echinoconus subrotundus, *Mantell*, 1822. Pl. LII, fig. 1 *a—f*; Pl. LIII, fig. 2 *a—f*, fig. 3.

Conulus	subrotundus,	*Mantell.* Geol. of Sussex, p. 191, tab. xvii, figs. 15—18, 1822.
Galerites	subrotunda,	*Agassiz.* Monogr. des Radiaires, Mem. Soc. des Sc. Nat. de Neuchatel, t. i, p. 186, 1836.
—	—	*Desmoulins.* Études sur les Échinides, p. 256, 1837.
—	—	*Dujardin.* In Lamarck's Animaux sans Vertébres, 2e ed., t. iii, p. 313, 1840.
—	—	*Desor.* Monogr. des Galérites, p. 18, tab. ii, figs. 11—14, 1842.
—	—	*Morris.* Catalogue of British Fossils, p. 53, 1843.
—	—	*Agassiz* and *Desor.* Catal. rais. des Échinides, Ann. Sc. Nat., 3e série, t. vii, p. 148, 1847.
—	Leskei,	*Desor.* Id., p. 148, 1847.
—	subtruncata,	*d'Orbigny.* Prod. de Pal., t. ii, p. 272, 1850.
—	subrotundus,	*Forbes.* In Dixon's Geol. of Sussex, p. 340, 1850.
—	—	*Forbes.* Mem. of Geol. Survey, decade iii, p. 6, 1850.
—	—	*Morris.* Catal. of Brit. Foss., 2nd ed., p. 80, 1854.
Echinoconus	—	*d'Orbigny.* Rev. et Mag. Zoologie, t. vi, p. 20, 1854.
—	—	*Cotteau.* Paléontol. Française terrains Crétacés, t. vi, p. 517, pl. 997, figs. 8—12, 1856.
Galerites	—	*Desor.* Synopsis des Échinides Foss., p. 183, 1856.
Echinoconus	—	*Cotteau.* Échinides de la Sarthe, p. 283, pl. xlvii, fig. 4, 1860.

Diagnosis.—Test subcircular, rounded anteriorly, a little contracted, and subangular posteriorly; upper surface elevated, sub-conoidal and convex; base flat, rounded at the border, sides a little inflated; mouth-opening small, roundish central; vent large, marginal, elliptical; ambulacra narrow, plates of both areas covered with small flat, equal-sized tubercles.

Description.—Under the name *Galerites vulgaris,* Leske, it is probable that moulds of *E. subrotundus* have been included. Klein's tab. xiii, fig. c—k, and tab. xiv, fig. a—k, are cited by Lamarck as types of *G. vulgaris.* As these figures all represent siliceous moulds, a doubt may be allowed to rest on their identity with the form I have figured in Plates LII and LIII. Dr. Mantell also gave the name *Conulus subrotundus* to a doubtful cast; but Desor has published excellent figures of this species from an English specimen collected in the Isle of Wight, and contained in the Museum at Neufchatel. Professor

Agassiz made a cast of this specimen for his collection of moulds of fossil Echinoderms. This form, therefore, has become classical, and I prefer to retain it, with Mantell's name, as M. Cotteau has done, in his beautiful work on the 'Fossil Échinides of the Department of the Sarthe.'

Echinoconus subrotundus is a common Urchin in the Lower English Chalk. The subcircular outline being rounded anteriorly, and a little contracted posteriorly, sometimes is slightly sub-pentagonal, as in the large specimen figured in Pl. LIII, fig. 2 *a*, *b*; the upper surface is elevated and convex, or sub-conoidal. A fine series of well-preserved specimens gives about equal numbers of both forms. The base is narrow and flat, and much rounded off at the border; the sides are tall and convex, not much inflated. Mr. Bone has given admirable figures of this species in Pls. LII and LIII, with full details of the anatomy of the test.

The ambulacral areas are narrow and lanceolate, Pl. LII, fig. 1 *b*, *c*, Pl. LIII, fig. 2 *a*, *b*, and composed of small plates, of which five are opposite one large inter-ambulacral plate. Pl. LIII, fig. 2 *e*, representing a portion of the large test near the ambitus magnified four times, shows the structure of the ambulacra; two rows of tubercles occupy the area, and form thereon irregular oblique rows; the poriferous zones are extremely distinct; the pores are very small, one oblique pair corresponding to each plate.

The inter-ambulacral areas are nearly three times the width of the ambulacral, and formed of wide deep plates (Pl. LII, fig. *d*, Pl. LIII, fig. 2 *e*). In the large specimen (Pl. LIII, fig. 2 *c*, *d*) there are fifteen plates in each column between the border and the disc, and six or seven between the border and the periostome; each plate supports three or four longitudinal series of tubercles arranged in quincuncial order, fig. 2 *e*, each surrounded by an areola, and having its summit perforated; the tubercles on both areas are very small, indistinct, and nearly homogeneous, and can only be seen with a lens, so that the shell appears quite smooth to the naked eye. The inter-tubercular surface is covered with microscopic granulets.

The base is flat, Pl. LII, fig. 1 *a*, Pl. LIII, fig. 2 *b*, sometimes it is undulated from the convexity of the basal inter-ambulacra, and the tubercles are a little larger than those on the sides; Pl. LIII, fig. 3, represents the arrangement they assume on three basal plates magnified six times; the bosses are crenulated, and the tubercles perforated.

The mouth-opening is small and central, about one seventh the diameter of the base; and the periostome presents very feeble indications of entailles (fig. 2 *b*).

The vent is larger than the oral opening, and occupies the border (Pls. LII and LIII); it has an elliptical form, placed vertically, the most acute angle being directed upwards (Pl. LIII, fig. 2, *b*, *d*); the opening is on the same plane with the border of the test, and the single inter-ambulacrum is neither tumid or rostrated, like *E. abbreviatus* (Pl. LIII, fig. 1).

The apical disc is firmly soldered to the surrounding plates, and is almost always well preserved; it is small, and consists of five ovarial plates, four of which are perforated, and one single imperforate, the antero-lateral plate is large, and projects into the centre of

the disc, supporting on its surface the madreporiform body. The five ocular plates are very small cordate bodies, wedged between the ovarials (Pl. LII, fig. *e*, Pl. LIII, 2 *f*). The surface of all the discal elements is covered with microscopic granulets.

Affinities and Differences.—This species resembles some globular varieties of *E. vulgaris*, and is often grouped with these in collections. It has a more globular form and is less elongated, the ambitus is more rounded, and the vent opens higher up in the border. It differs from *E. castanea* in the general outline of the test by being more globular, and elevated with a more convex dorsal surface. The same characters distinguish this species from *E. conicus*, from which, however, it further differs in having smaller tubercles, and a more microscope form of granulation. It differs from *E. abbreviatus* in the general form of the test, and in having much smoother plates, from the smallness of its tubercles; those in *E. abbreviatus* being larger, and surrounded by a more prominent granulation; the vent likewise is more inferior, and the single interambulacrum neither tumid nor rostrated as in this species.

Locality and Stratigraphical Position.—I collected my large specimen from the Lower Chalk, near Lewes, in Sussex; it is found in the same stratum at Charing, in Kent, and in the Lower or Hard Chalk at Feltwell Marborough, in Norfolk, it is therefore a fossil characteristic of the Lower Chalk, and in this respect differs from *E. conicus*, *E. globulus*, and *E. abbreviatus*, which all appertain to the Medial and Upper Chalk. The Rev. T. Wiltshire, F.G.S., has collected this species in the Lower Chalk, near Folkestone, from a stratum fifteen feet above the bed of hard gritty chalk, but never in the gritty chalk itself.

B.—*Species from the Medial Chalk.*

ECHINOCONUS CONICUS, *Breynius*, 1732. Pl. XLIX, figs. 2, 3, 4; Pl. L, figs. 1—6.

ECHINOCONUS VERÈ CONICUS,	*Breynius.* Sched. de Echinis, p. 57, pl. iii, fig. 12, 1732.
CONULUS ALBOGALERUS,	*Klein.* Natur. dispositio Echinoderm., p. 24, tab. xiii, A, B, 1734.
ECHINITE CONOIDE,	*Bourguet.* Trait. des Petrif., p. 77, pl. liii, fig. 360, 1742.
CONULUS ALBOGALERUS,	*Leske.* Apud Klein, p. 162, tab. xiii, A, B, 1778.
ECHINUS —	*Gmelin.* Systema Naturæ, p. 3181, No. 46, 1789.
— —	*Bruguière.* Tab. Encycl. Atlas, pl. clii, figs. 5, 6, 1791.
CONULUS —	*Parkinson.* Organic Remains, vol. iii, pl. ii, figs. 10, 11, 1811.
GALERITES —	*Lamarck.* Animaux sans Vert., t. iii, p. 20, 1816.
— —	*Defrance.* Dic. Sci. Nat., t. xviii, p. 86, 1820.
— —	*Brongniart.* Foss. envir. de Paris, p. 631, pl. l, fig. 12, 1822.

Galerites pyramidalis,	*Brongniart.* Idem.
Conulus albogalerus,	*Mantell.* Geol. of Sussex, p. 190, pl. xvii, figs. 16—19, 1822.
Galerites —	*Deslongchamps.* Zoophytes Ecycl. Method., t. ii, p. 431, 1824.
— —	*Goldfuss.* Petrefacta, t. i, p. 127, pl. xl, fig. 19, 1826.
Conulus —	*Fleming.* History of British Animals, p. 481, 1828.
Galerites —	*Stokes.* Trans. Geol. Soc. Lond., 2nd ser., vol. ii, p. 406, pl. xlv, figs. 14, 15, 1829.
Echinoneus —	*De Blainville.* Zoophytes Dic. Sc. Nat., t. lx, p. 194, 1830.
Discoidea albogalera,	*Agassiz.* Monogr. des Radiair., Mém. Soc. Neuf., t. i, p. 186, 1836.
— —	*Desmoulins.* Études sur les Échinid., p. 248, 1837.
Galerites pyramidalis,	*Desmoulins.* Idem.
— albogalerus,	*Agassiz.* Catal. Syst. Ectyp. Foss., p. 6, 1839.
— pyramidalis,	*Agassiz.* Idem.
— albogalerus,	*Dujardin.* In Lamarck, 2nd ed., t. iii, p. 306, 1840.
— pyramidalis,	*Dujardin.* In Lamarck, idem.
— albogalerus,	*Rœmer.* Norddeutschen Kreidegebirges, p. 32, 1840.
— —	*Desor.* Monogr. des Galérites, tabs. i and xiii, p. 11, 1842.
— pyramidalis,	*Desor.* Idem, p. 13, tab. i, figs. 1—3.
— angulosa,	*Desor.* Idem, p. 22, tab. iv, figs. 5—7.
— albogalerus,	*Morris.* Catalogue of British Fossils, p. 53, 1843.
— —	*Agassiz* and *Desor.* Catal. rais. des Échinides, Ann. Sc. Nat., 3rd ser., t. vii, p. 148, 1847.
— pyramidalis,	*Agassiz* and *Desor.* Idem.
— angulosa,	*Agassiz* and *Desor.* Idem.
— —	*d'Orbigny.* Pal. Stratigraph., t. ii, p. 272, 1850.
— albogalerus,	*d'Orbigny.* Idem.
— —	*Forbes.* In Dixon's Geol. of Sussex, p. 340, 1850.
— —	*Sorignet.* Oursin Foss. de l'Eure, p. 40, 1850.
— —	*Forbes.* Mem. Geol. Survey, decade iii, pl. viii, 1850.
— —	*Bronn.* Lethæa Geognost. Kreidegebirges, p. 191, pl. xxix, fig. 18, *a*, *b*, 1857.
— —	*Quenstedt.* Handbuch der Petrefak., p. 583, 1852.
Echinoconus —	*d'Orbigny.* Revue et Mag. de Zoologie, p. 20, 1854.
— pyramidalis,	*d'Orbigny.* Idem.
— angulosus,	*d'Orbigny.* Idem.
Galerites albogalerus,	*Forbes.* In Morris's Catalogue of Brit. Foss., 2nd ed., p. 80, 1854.
Echinoconus —	*Cotteau.* Ech. Foss. Pyrénées, Bulletin Soc. Géol. de France, 2e sér., t. xiii, p. 258, 1856.
— conicus,	*d'Orbigny.* Palæontol. Française ter. Crétacés, t. vi, p. 513, pl. 996, 1856.
— subpyramidalis,	*d'Orbigny.* Idem, pl. 1000, p. 530.
Galerites albogalerus,	*Pictet.* Traité de Paléont., pl. xcv, fig. 12, 1857.

Galerites albogalerus,	*Desor.*	Synopsis des Échinides Foss., pl. xxv, 1857.
Echinoconus conicus,	*Cotteau.*	Échinides du Départ. de la Sarthe, pl. 47, figs. 1—3, 1860.

Diagnosis.—Test much elevated, conoidal, larger anteriorly than posteriorly; slightly angular and rounded at the border; base flat; single inter-ambulacrum tumid and recurved; vent large, oval, infra-marginal; mouth-opening central, periostome decagonal, armed with five pairs of dentiferous jaws; ambulacra straight, narrow, doubly lanceolate; pores small, unigeminal, in oblique pairs, which become trigeminal near the periostome; interambulacra wide, angular; tubercles on both areas small, homogeneous; granules abundant, unequal, sometimes elongated and prominent; apical disc small, quadrangular, very solid.

Dimensions.—Height, one inch and five tenths; latitude, one inch and four tenths.

Description.—I recognise three well-marked varieties of form in this Urchin, which have been described as distinct species by different systematic authors: these are, according to my reading of the matter, as follows:—

Forma α. *Conica.*—This may be regarded as the normal form, and as such it is figured as the type of the species.

Forma β. *Pyramidalis.*—Desor, 'Monographie des Galérites,' Pl. I, figs. 1—3; d'Orbigny, Paléontologie Pl. 1000, figs. 5—7. A small test, with pyramidal elongation of the vertex.

Forma γ. *Angulosa.*—Desor, 'Monographie des Galérites,' Pl. 4, figs. 5—7, a depressed, elongated, and angular variety of *Conica.*

Description.—This is the most typical of all the Echinoconi, and has been well figured and described by most classical authors who have described the different forms of this genus. It is the true *Echinoconus vere conicus* of Breynius, 1732; two years later it was figured and described as *Conulus albo-galerus* by Klein, on account of its supposed resemblance to the white caps worn by the priests of Jupiter. Lang figured it in 1708 as *Echinometritis* in his 'Historia Lapidum figuratorum Helvetiæ,' and Bourget in his 'Traité de Petrifactions,' as the *Echinite conoide,* whilst Lamarck made it the type of his new genus Galerites, reserving for it the specific name *albo-galerus,* given by Klein, by which it has been known to the present time.

The general form of this Urchin is conical, varying in different specimens from a tall pyramid, with very steep sides, to a short one with inflated walls; the base is flattened, its circumference slightly pentangular, the greatest width corresponding to the region of the antero-lateral ambulacra; the basal angle is more or less rounded, and the single inter-ambulacrum tumid and recurved.

The ambulacral areas are doubly lanceolate, and built up of minute plates, which in the upper part of the area are often cuneiform in shape, irregular in size, and some-

times separated from each other by small accessory pieces; near the ambitus they have a more regular shape, as seen in Pl. L, fig. 1 *d*. All the plates are narrow, four or five corresponding in depth to one inter-ambulacral plate. In the large specimen drawn in Pl. XLIX, fig. 3, there are fifteen plates in each dorsal inter-ambulacral column between the angle of the disc, so that in this specimen, in the same space, there are seventy-five plates in each half of an ambulacral area; there are four rows of primary tubercles in the widest part of the area, which have a zig-zag arrangement, the two inner rows, which are the most irregular, disappear near to the middle of the base, and about the upper fourth of the dorsal surface. The poriferous zones are very narrow, the pores unigeminal and oblique, six pairs being often opposite one large plate; near the mouth they form sets of triple oblique pairs, as in the example (fig. 5), magnified four times; from several specimens before me in different stages of weathering, I have ascertained that a small cuneiform plate is apportioned to each pair of holes; this plate appears to have been formed of two halves, so as to embrace the tubular feet; the plates, therefore, of the poriferous zones are not perforated for the soft parts, but have, in fact, grown around them in the process of development.

The inter-ambulacral areas are three times the width of the ambulacral at the ambitus (Pl. L, fig. 1 *d*); they are formed of large plates, each supporting from 10 to 14 primary tubercles, arranged in irregular horizontal rows, which sometimes assume an hour-glass-shape-like disposition; each of these tubercles is spiniferous (fig. 1*f*), and is encircled by a smooth depressed areola; the boss is large, mammillated, and crenulated at the summit, and the small round head is perforated; those at the base are larger, and form more regular horizontal rows; when examined with an inch object-glass they present the appearance shown in fig. 1*f*. The inter-tubercular surface is covered with rows of microscopic granules (fig. 1 *d*, *e*, *f*); the tubercles on the upper surface all supported short spines, which are sometimes seen *in sitû*, those at the base are large, about one fifth of an inch in length; they are slender, tapering, smooth, and covered with fine longitudinal lines, which are delicately serrated near the summit, the stem is enlarged at the base, where it is encircled by a crenulated collar (fig. 3). Dr. Bowerbank made a microscopic examination of the spines of *Echinoconi* in his collection, and found that the dorsal spines of *E. conicus* differed from those of *E. subrotundus* in being thickened at the base, and set on tubercles as it were sessile, instead of being shortly pedunculated, as they are in the latter species.

The minute moniliform spines of *E. conicus*, according to Dr. Bowerbank, are $\frac{1}{133}$ of an inch in length, and of equal diameter (fig. 4). Three were accurately measured, and all were as nearly as possible of the same size and proportions; they were all perfectly smooth.

The mouth-opening is small and central (Pl. L, fig. 1 *b*); the periostome is decagonal (fig. 5), and armed with a dental lantern: this fact was first discovered by Mr. Charles Stokes, F.G.S., and described by him in the 'Geological Transactions;' since that time

PLATE XLV.

Cottaldia Benettiæ, *König*, 1825.

From the Upper Greensand.

Fig. 1 *a*, 2 *a*, 3. Lateral views of tests, natural size. My collection. (P. 187.)

b. Upper surface of test, showing the apical disc, magnified two diameters. My collection.

c. Under surface of same, showing the base and peristome, do. do.

d. Lateral view of do. do. the lobe-like character of the areas, do.

e. Portion of the inter-ambulacral and ambulacral areas and poriferous zones, showing the linear arrangement of the tubercles on the plates, magnified ten times.

f. Portion of the inter-ambulacral plates and tubercles at the base, magnified ten times.

g. Apical disc complete, do. magnified six times.

Discoidea subuculus, *Klein*, 1734.

From the Upper Greensand and Grey Chalk.

Fig. 4 *a*. Lateral view of test, the natural size. My collection. (P. 200.)

b. Upper surface of same, magnified two diameters.

c. Under do. do. do. do.

d. Lateral do. do. do. do.

e. Apical disc, magnified twelve times.

f. Upper portion of inter-ambulacral areas, do.

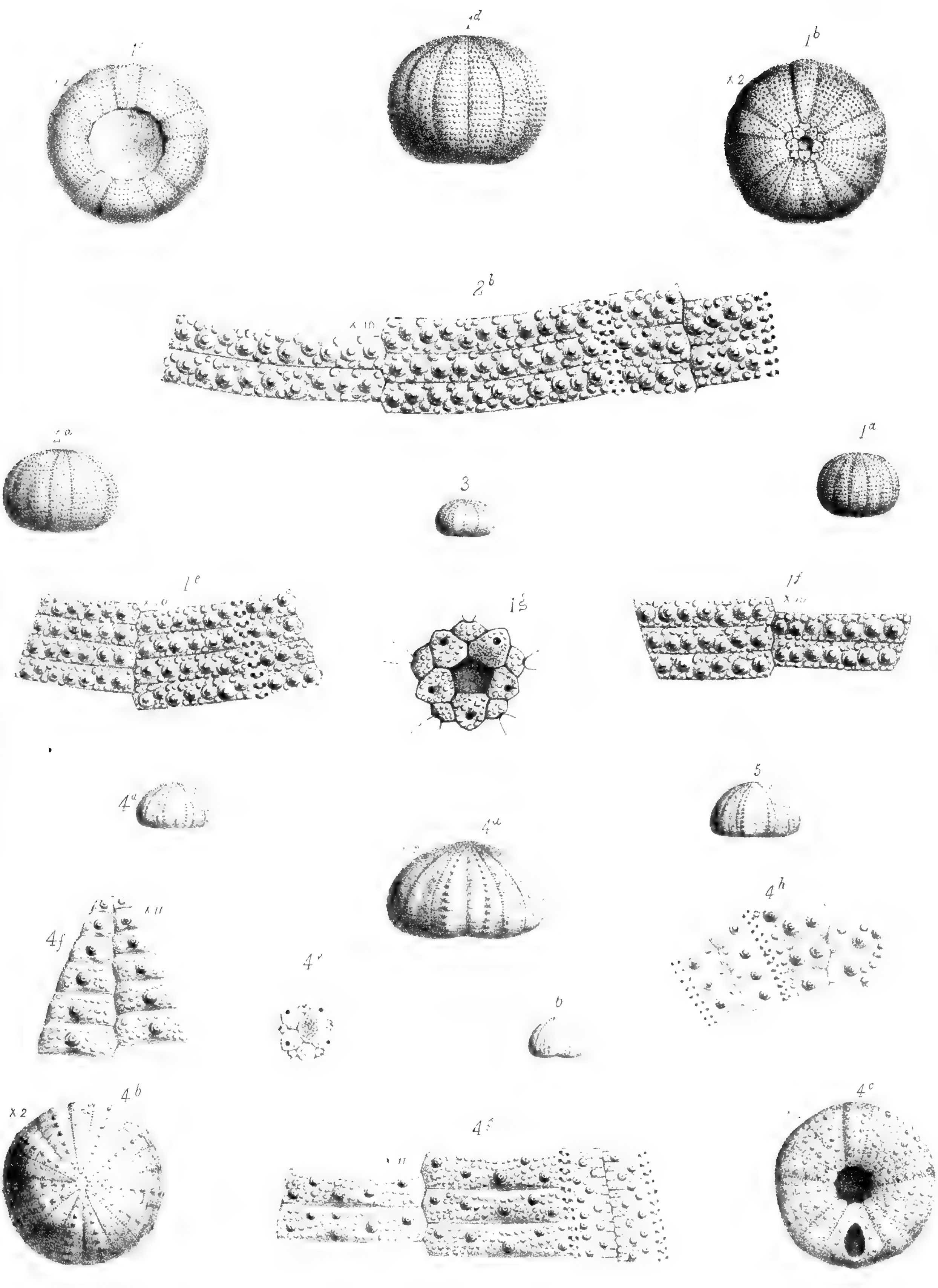
g. Plates of inter-ambulacra, ambulacra, and poriferous zones, magnified eleven times.

h. Do. do. do. do. at base, do. do.

Fig. 5. Large test from the Grey Chalk.

6. Small test, conical variety, do.

Pl. XLV.



C R Bone del et lith

M & N Hanhart imp

PLATE XLVI.

Discoidea cylindrica, *Lamarck,* 1816.

From the Lower Chalk.

Fig. 1 *a*. Upper surface of a large test, natural size. My collection. (P. 204.)

b. Under do. do. do.

c. Lateral view of another test, from the Chloritic Chalk, natural size.

d. Inter-ambulacral and ambulacral plates, with poriferous zones, and showing distribution of the tubercles, magnified four times.

Fig. 2 *a*. A small test from the Lower Grey Chalk, showing a lobed variety of the same species, lateral view, natural size. My collection.

b. Under surface of the same, do.

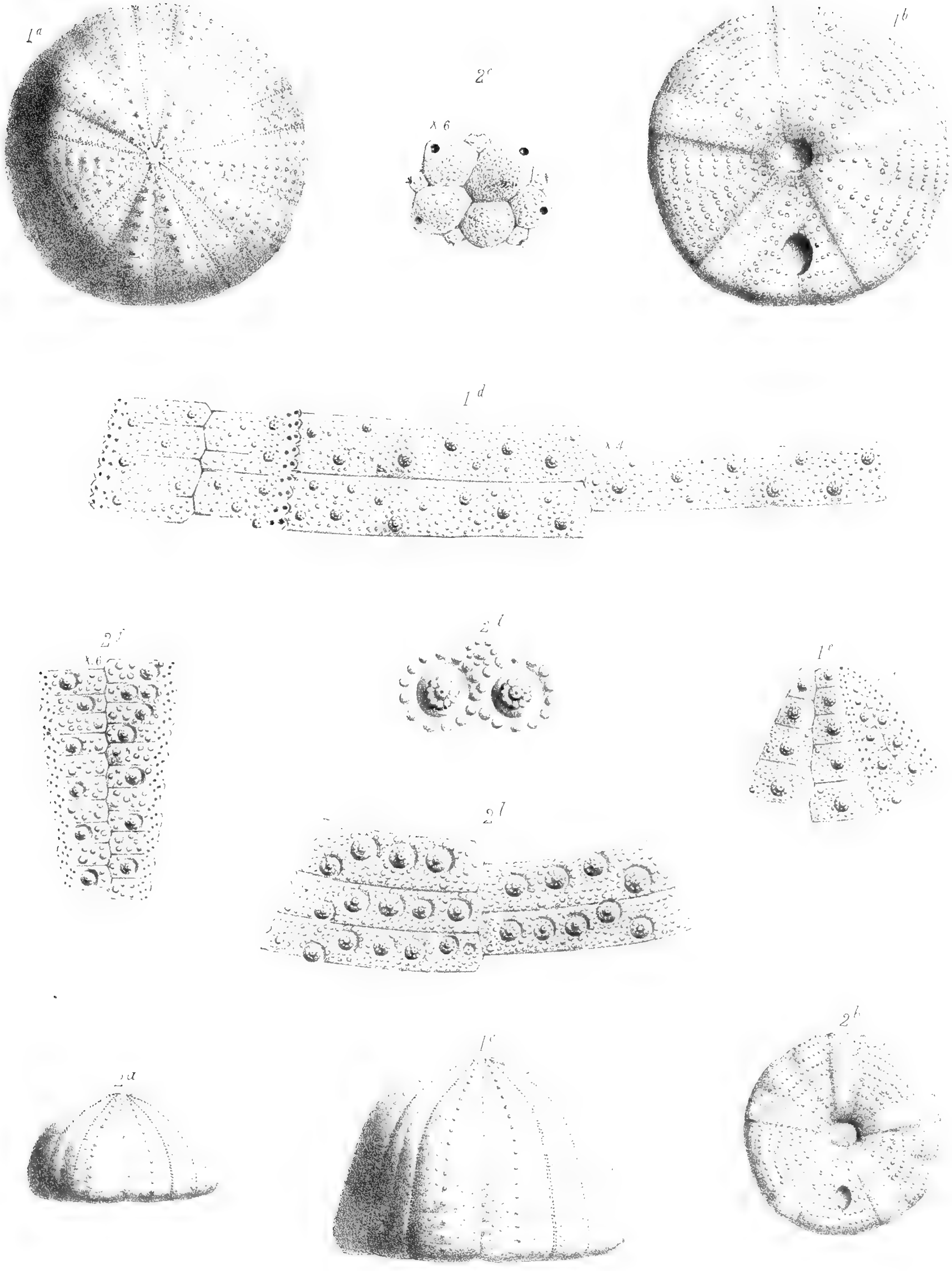
c. Apical disc, magnified six times.

d. Primary tubercles, showing detailed structure, highly magnified.

e. Upper portion of the inter-ambulacra, ambulacra, and poriferous zones, magnified six diameters.

f. A portion of the basal ambulacral plates and poriferous zones, magnified six times.

l. A portion of the basal inter-ambulacral do. do. do.



C R Bone del et lith

M & N Hanhart imp

PLATE XLVII.

Discoidea cylindrica, *Lamarck*, 1816.

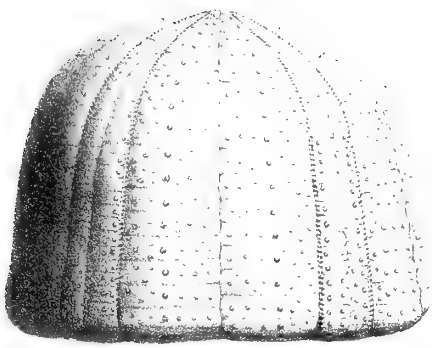
Fig. 1 *a*. Large test, lateral view, natural size. My collection. (P. 204.)
b. Base of the same, do.
2 *a*. Mould showing marginal incisions on the border of the inter-ambulacra.
b. Mould showing the extension of the same at the base.
3. Test wanting anterior single ambulacrum.

Discoidea minima, *Agassiz*, 1840.

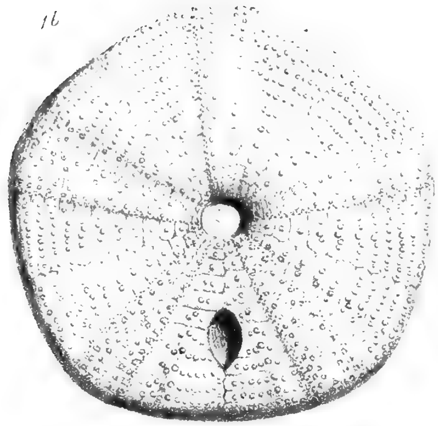
Fig. 4 *a*. Upper surface of a test, natural size. (P. 208.)
b. Under surface do. do.
c. Lateral view do. do.
d. Base of do. magnified.
e. Apical disc, greatly magnified.
f. Portion of the inter-ambulacrum, ambulacrum, and poriferous zones, highly magnified.
g. Upper portion of the same parts, highly magnified.
h. The anal plates, highly magnified.

These figures are copied from M. Cotteau's beautiful plate 1012, figs. 1—7, in the 'Paléontologie Française,' tom. vii.

1 a



1 b



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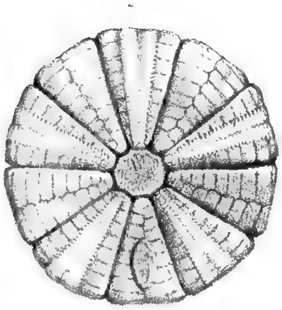

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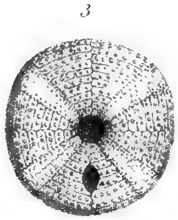

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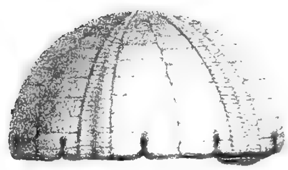

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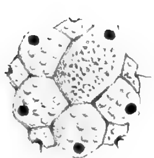

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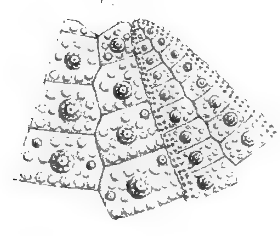

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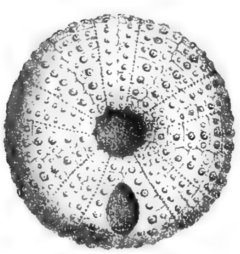

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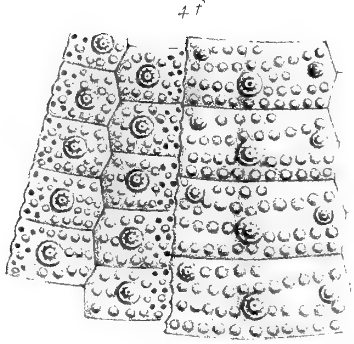

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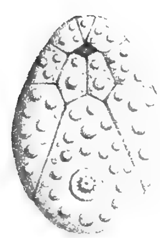


Bone del. et lith.

M & N Hanhart imp.

PLATE XLVIII.

Discoidea Favrina, *Desor*, 1842.

From the Upper Greensand.

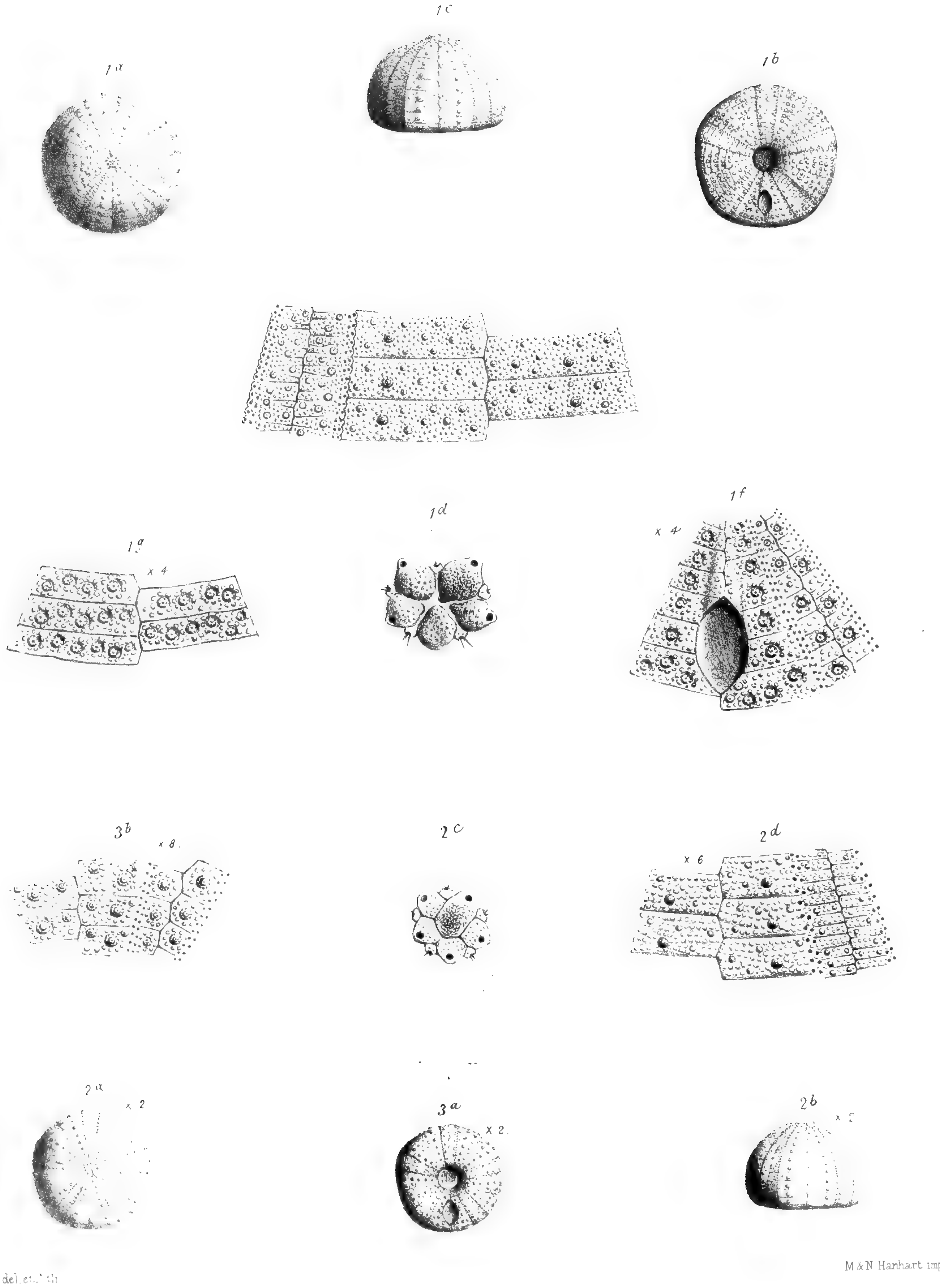
Fig. 1 *a*. Upper surface of a test, natural size. British Museum. (P. 210.)
b. Base of do. do. do.
c. Lateral view of do. do. do.
d. Apical disc, magnified.
e. Inter-ambulacra, ambulacra, and poriferous zones, magnified four times.
f. Portion of the basal plates of the same parts, do. do.
g. Inter-ambulacral plates, do. do.

Discoidea Dixoni, *Forbes*, 1850.

From the Upper White Chalk.

Fig. 2 *a*. Upper surface, magnified two diameters. My collection. (P. 212.)
b. Lateral view, do. do.
c. Apical disc, highly magnified.
d. Inter-ambulacra, ambulacra, and poriferous zones, magnified six times.
3 *a*. Base of another test, magnified two diameters.
b. Inter-ambulacra, ambulacra, and poriferous zones, magnified eight times.

Pl. XLVIII.



J.R. Bone del. et lith

M & N Hanhart imp

PLATE XLIX.

ECHINOCONUS GLOBULUS, *Desor*, 1842.

From the Upper Chalk.

Fig. 1 *a*. Upper surface of a test, natural size. British Museum. (P. 230.)

b. Under do. do. do. do.

c. Lateral view do. do. do.

d. Posterior view do. do. do.

e. Inter-ambulacra, ambulacra, and zones, magnified six diameters.

f. Apical disc, magnified.

g. Tubercles of base.

ECHINOCONUS CONICUS, *Breynius*, 1732.

Fig. 2 *a*. Posterior view of a test, natural size. My collection. (P. 221.)

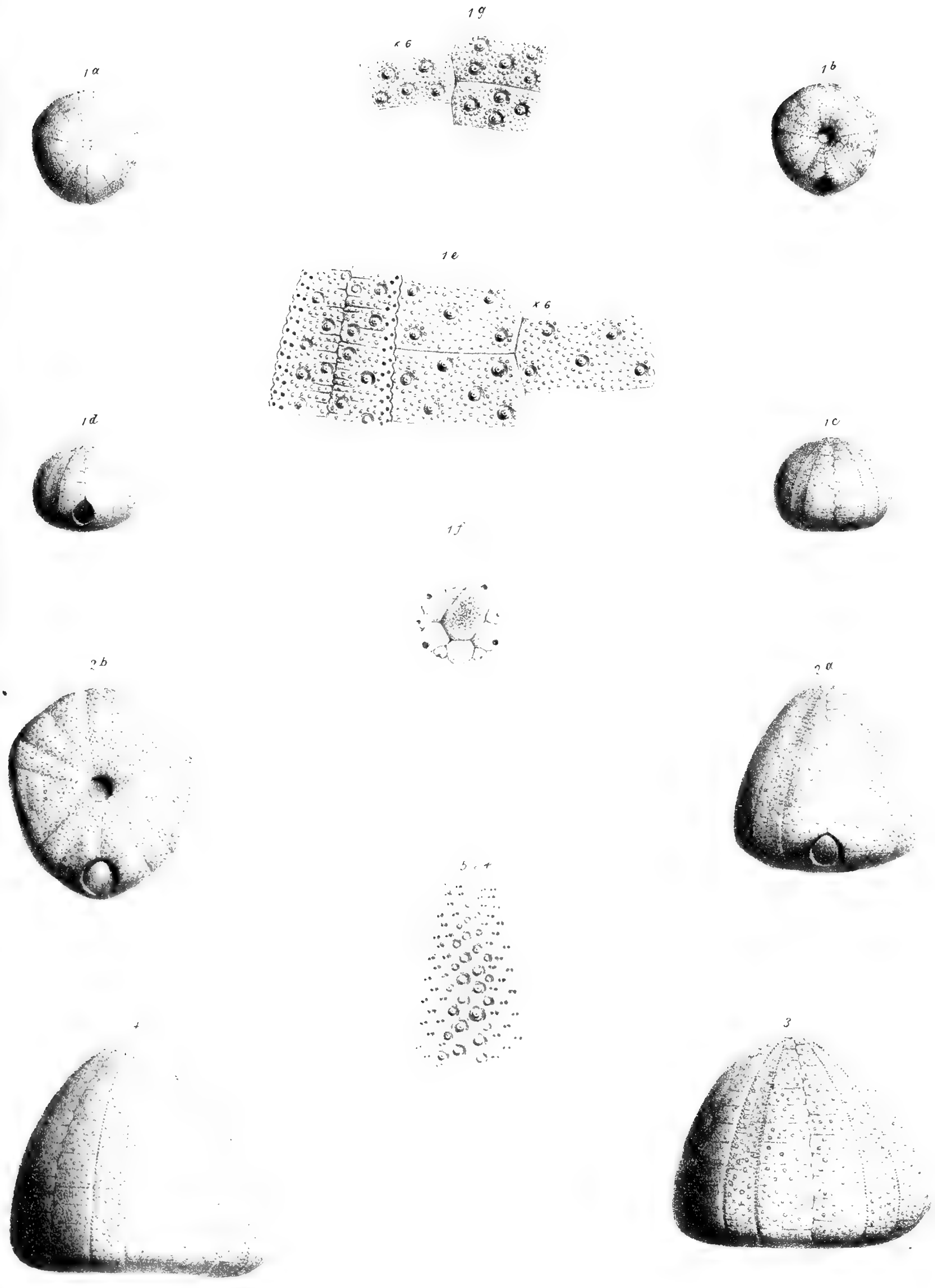
b. Base of the same showing the relative dimensions of vent and peristome.

3. Lateral view of another test.

4. Do. do.

5. Poriferous zones around the periostome, showing the arrangement of triple oblique pairs of pores in that region, magnified four times.

Pl. XLIX.



C R Bone del et lith

M & N Hanhart imp

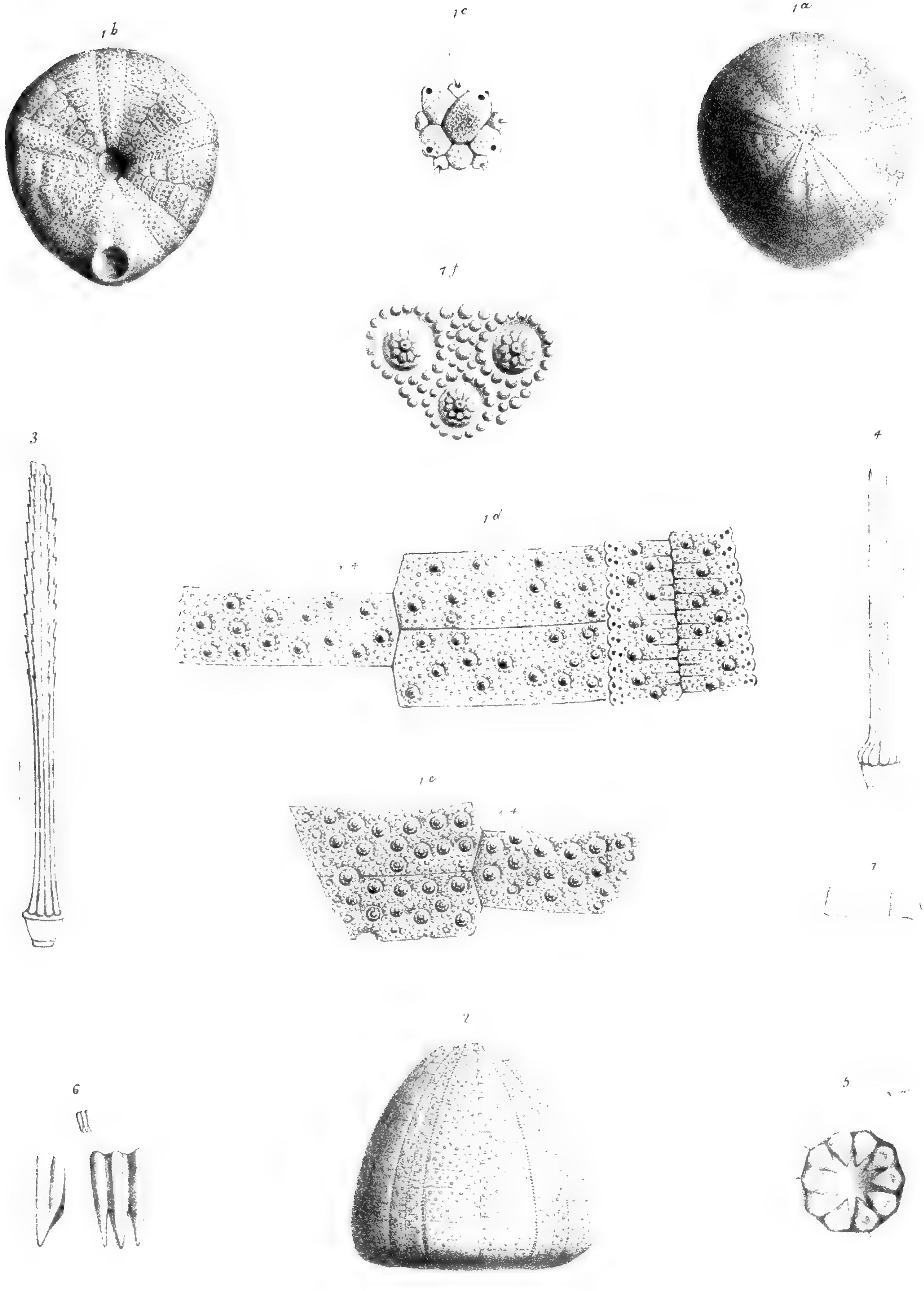
PLATE L.

ECHINOCONUS CONICUS, *Breynius*, 1732.

From the Upper Chalk.

Fig. 1 *a*. Upper surface of test, natural size. My collection. (P. 221.)
b. Under do. do. do.
c. Apical disc, magnified four diameters.
d. Inter-ambulacra, ambulacra, and poriferous zones, magnified four diameters.
e. Do. do. do. near the base, do.
f. Primary tubercles and surrounding granules, highly magnified.
2. Lateral view of a highly conical test.
3. Primary spine, natural size, and highly magnified.
4. Do do. do. do. The Rev. Thos. Wiltshire, F.G.S.
5. Peristome with jaws and teeth *in sitú* do.
6. The jaws and teeth magnified do.
7. Small tubercular spines of the dorso-lateral plates, greatly magnified.

Pl L



C R Bone del et lith

M & N Hanhart imp

PLATE LI.

ECHINOCONUS GLOBULUS, *Desor*, 1842.

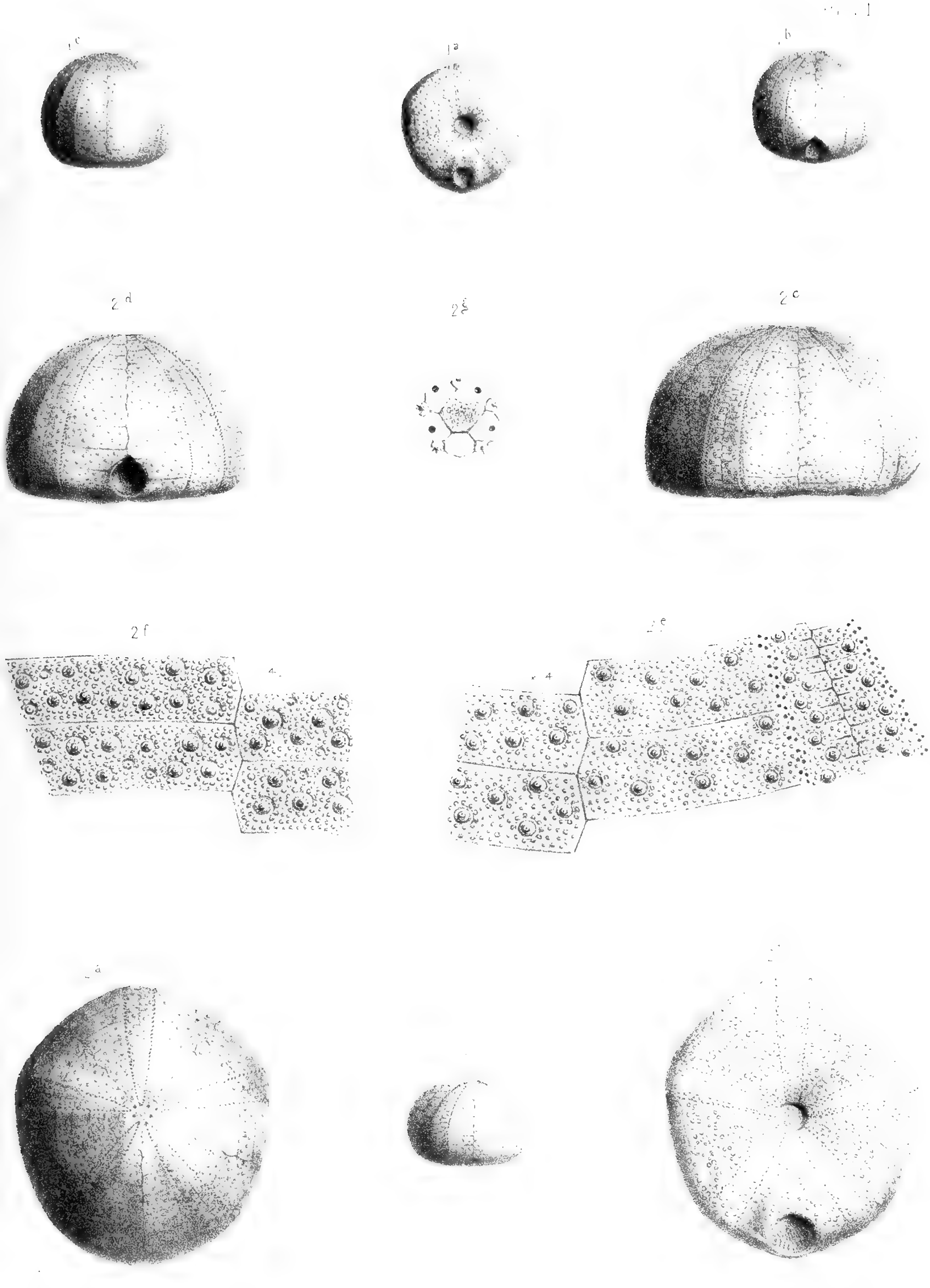
From the Upper Chalk.

Fig. 1 *a*. Base of the test, natural size. The Rev. T. Wiltshire, F.G.S. (P. 230.)
b. Posterior view do. do. do.
c. Lateral do. do. do. do.

ECHINOCONUS CASTANEA, *Brongniart*, 1842.

From the Lower Chalk.

Fig. 2 *a*. Upper surface of a large test, natural size. My collection. (P. 215.)
b. Under do. do. do.
c. Lateral view do. do.
d. Posterior do., showing the position of the marginal vent.
e. Inter-ambulacral and ambulacral plates, and poriferous zone, magnified four diameters.
f. Do. from basal region.
g. Apical disc.
3. A small test of the same species, natural size.



C.R. Bone ... del. ... Hanhart imp.

PLATE LII.

ECHINOCONUS SUBROTUNDUS, *Mantell*, 1822.

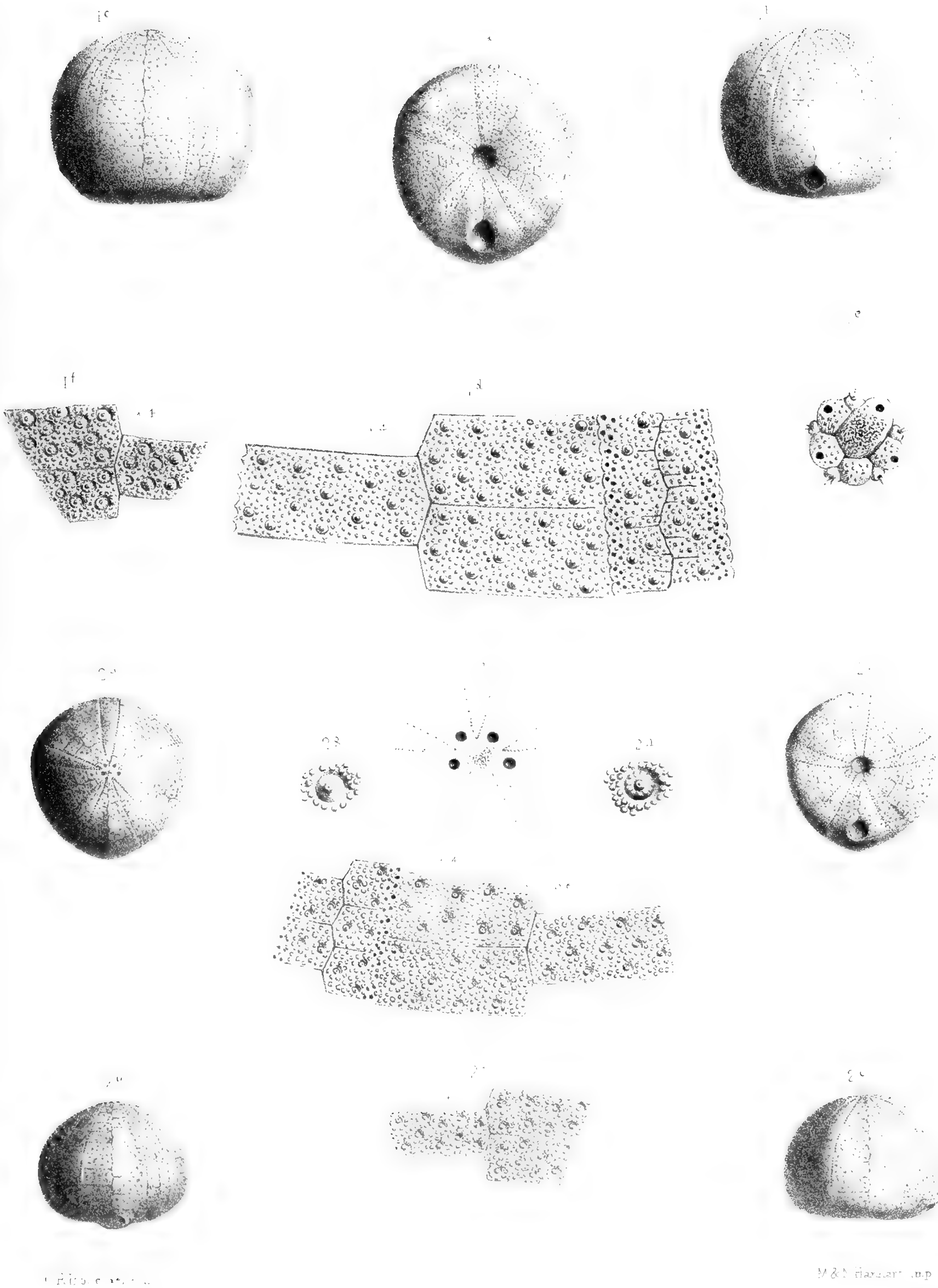
From the Lower Chalk.

Fig. 1 *a*. Base of test, natural size. Rev. T. Wiltshire, F.G.S. (P. 219.)
c. Lateral view, do.
b. Posterior do. do.
d. Inter-ambulacra, ambulacra, and poriferous zones, magnified four times.
e. Apical disc, do.
f. Portion of the basal plates, do.

ECHINOCONUS ABBREVIATUS, *Desor*, 1842.

From the Upper Chalk of Norfolk.

Fig. 2 *a*. Upper surface of the test, natural size. My collection. (P. 226.)
b. Base do. do.
c. Lateral view do. do.
d. Posterior do., with recurved vent.
e. Inter-ambulacra, ambulacra, and zones, magnified four diameters.
f. Portion of the basal plates, do. do.
g. Primary tubercle, magnified.
h. Do. do.
i. Apical disc do.



M & N Hanhart imp.

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A MONOGRAPH

OF THE

BRITISH FOSSIL BRACHIOPODA.

BY

THOMAS DAVIDSON, F.R.S., F.G.S.,

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VOL. IV.

PART I.

SUPPLEMENT TO THE RECENT, TERTIARY, AND CRETACEOUS SPECIES.

PAGES 1—72; PLATES I—VIII.

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AUTHOR'S NOTE.

In the year 1871 I completed my work on British Fossil Brachiopoda; and I now propose, in a series of Supplements, to revise the old work, correct some of its mistakes, and add descriptions and figures of those species which have been discovered since the publication of the Monographs to which they respectively belong. This will add a fourth volume to the work, and end my labours in connection with the British Brachiopoda.

I avail myself of the present opportunity to tender my grateful thanks to the Council of the Royal Society for having awarded to me (in 1870) one of their Royal Medals in consideration of the work I had completed. The honour and reward were, it is true, far beyond my deserts, but have operated as an incentive to renewed exertions on my part.

T. D.

A MONOGRAPH

OF

BRITISH FOSSIL BRACHIOPODA.

BRITISH RECENT BRACHIOPODA.

SINCE 1850 our information in connection with the recent species has vastly increased; and we are indebted to Mr. J. G. Jeffreys for the larger portion of that which relates to those inhabiting our British seas.

This is not, however, the fitting place to enter upon lengthened details, synonyms, and descriptions, with reference to the recent species. We must therefore confine ourselves to a brief enumeration of the species discovered up to the year 1873, and refer the student for more ample information to Forbes and Hanley's 'History of British Mollusca' (1849), to Mr. J. G. Jeffreys' excellent work on 'British Conchology' (vol. ii, pp. 1—26, and vol. v, pp. 163—165),[1] and to the works of several other persons. I am likewise indebted to Mr. Jeffreys for having furnished me with the habitat and range of depth of several of the species; in a great measure, from the Reports of the 'Lightning' and 'Porcupine' Expeditions.

It is a subject of considerable interest to ascertain how many of the species occur both recent and fossil; an inquiry that cannot be ignored in a work treating of the fossil species of Great Britain.

[1] In vol. viii (1870), vol. xi (1871), and vol. xii (1872) of the 'Journal de Conchiliologie' Mr. P. Fischer has published an interesting series of articles on the recent Brachiopoda which occur near the oceanic coasts of France, namely, *Crania anomala*, *Terebratulina caput-serpentis*, *Waldheimia cranium*, *Megerlia truncata*, *Argiope decollata*, *A. cistellula*, *A.* (?) *capsula*, and *Platidia Davidsoni.*

1. Discina Atlantica, *King*. Dav., Supplement, Pl. I, figs. 11, 11 *a*, 11 *b*.

'Proceedings of the Natural History Society of Dublin,' 1868.

This species is described by Prof. King as "Corneous, brown, thin; rather prominently conical; marginal outline approximately circular; sides scarcely convex; two and a half sixteenths of an inch in diameter, and one sixteenth in height; apex subcentral, and on the posterior half; outer surface, as seen with a good pocket lens, crowded with fine, regular, subparallel, concentric, raised lines; inner surface showing, under a high magnifying power, a delicate, scaly, or imbricated appearance; anterior portion of a yellowish-white colour; muscular impressions well marked."

Four examples of the upper or unattached valve only of this minute shell have been obtained. One, the original specimen, was taken by Capt. Hoskyn attached to the sounding lead off the "Porcupine Bank," on the west coast of Ireland, at a depth of 1240 fathoms. The second was dredged by Mr. Jeffreys in nearly the same place and 1366 fathoms. The two remaining examples were found by Sir James Anderson, in the North Atlantic, when fishing up telegraph cable, in more than 2000 fathoms depth.

I have carefully examined all the specimens, and am confident as to the correctness of Prof. King's generic indentification; the corneous nature of the shell and shape of its muscular impressions would preclude the possibility of its being referred to the genus *Crania*.

2. Crania anomala, *Müller*. Dav., Tertiary Mon., Pl. I, fig. 1.

Crania anomala, *Forbes* and *Hanley*. British Mollusca, pl. lvi, figs. 7, 8.
— — *Jeffreys*. Brit. Conch., vol. ii, p. 24, pl. i, fig. 3, and vol. v, pl. xix, fig. 6, &c.

This well-known species, stated by Mr. Jeffreys to occur on almost every part of the Scotch and Irish coasts, is abundant at Oban, in Loch Fine, the Orkneys, Isle of Man, &c. The depth at which it is found varies considerably. Thus, off the west coast of Ireland it occurs at depths of 90, 150, 670, and 808 fathoms. Between Shetland and Faroe Isles, at 200 to 250 fathoms; north of Hebrides, 170 to 530 fathoms (Carpenter and Thomson). It is very abundant in seas of other parts of the world.

3. Terebratulina caput-serpentis, *Linné*. Dav., Tert. Mon., Pl. I, figs. 3—6.

Terebratulina caput-serpentis, *Forbes* and *Hanley*. British Mollusca, pl. lvi, figs. 1—4.
— — — *Jeffreys*. Brit. Conch., vol. ii, p. 14, and vol. v, pl. xix, figs. 2, 6.

The following are some of its British habitats and depths :

Off Hebrides, 189 fathoms (Carpenter and Thomson).

Off Faroe Isles, 170 fathoms (Carpenter and Thomson).

Off west of Ireland, 90 to 808 fathoms (J. Gwyn Jeffreys).

Mr. David Robertson and others have dredged it off Oban, in Loch Fine, and at Loch Cumbrae. It occurs attached to stones, old shells, and, according to Mr. Jeffreys, occasionally to small sea-weeds and other substances.

4. Waldheimia cranium, *Müller*. Dav., Tert. Mon., Pl. I, fig. 8 (not fig. 8 *a*); Appendix, Pl. A, fig. 1 (for interior).

Terebratula cranium, *Müller*. Zool. Dan. Prodr., p. 249, No. 3006.
— — *Forbes* and *Hanley*. Hist. of Br. Moll., vol. ii, p. 357, pl. lvii, fig. 10.
— — *Jeffreys*. Brit. Conch., vol. ii, p. 11, and vol. v, p. 163, pl. xix, fig. 1, 1 *a*, &c.
Macandrevia — *King*. Proc. of Dublin University Zool. and Botanical Institution, vol. i, p. 261, 1859.

This species has been frequently described and illustrated. Its loop is long and reflected, as in Waldheimia, but, from being often found broken, some misconception as to its true nature has been entertained.

As justly observed by Jeffreys, *Waldheimia cranium* was mistaken by Fleming, Sars, and some others, for *Terebratula vitrea,* which has an entirely different apophysary arrangement; and I was myself misled as to its true character in 1853, but soon after corrected my mistake in Appendix, Pl. A, fig. 1.

Wald. cranium was found nearly sixty years ago by Prof. Fleming off Bressay Island, and specimens of various sizes and ages have been dredged in the same seas by Mr. Jeffreys, Mr. Barlee, and some others. Dr. Carpenter obtained it in 170 to 650 fathoms north of Hebrides. Mr. Jeffreys dredged it off the west coast of Ireland ('Porcupine' Expedition, 1869); in the Bay of Biscay and Channel Slope in 30 to 690 fathoms (Jeffreys); off Bayonne (Folin, *fide* Fischer).

It been has found fossil in the Post-Tertiaries of Norway and Pliocene of Sicily. The

shell attributed to this species from the Tertiary rocks of Belgium turns out to be referable to the *Mannia Nysti* of Dewalque.

5. Waldheimia septigera, *Löven*, sp. Dav., Supplement, Pl. I, figs. 1, 1 *a*.

Terebratula septigera, *Löven.* Index Molluscorum; Ofversigt af k. vet. Akad. Förh., 1846.
Waldheimia — *Dav.* Annals and Mag. of Nat. Hist., 2 ser., vol. xvi, pl. x, fig. 1, 1855.
— septata, *Philippi.* According to Jeffreys, &c.

The living form of this very remarkable species was first discovered by Löven, who gave a good description of it, but without a figure. In 1855 I made good the omission. It was then believed to be a rare species, but was subsequently dredged by Mr. Jeffreys and Dr. Carpenter, nearer the Orkney and Shetland than the Faroe Isles, in a depth of 203 to 345 fathoms. Also outside the Channel Slope, or "Chops of the Channel." Coasts of Norway (Löven, Sars, and others), in from 150 to 300 fathoms.

It occurs fossil in Sicily, Rhodes, Norway. Mr. Jeffreys is of opinion that the shell here noticed is the *Terebratula septata* of Philippi, a fossil occurring in the Pliocene rocks of Sicily; but as Sig. Seguenza is of a decidedly different opinion, and as some uncertainty may still prevail as to what really was Philippi's species, I have preferred retaining, at any rate provisionally, the name given to the recent form by Prof. Löven.

6. Terebratella Spitzbergensis, *Dav.* Dav., Supplement, Pl. I, figs. 2, 2 *a*.

Terebratella Spitzbergensis, *Dav.* Proceedings of Zool. Soc. of London, May, 1852, and Annals and Mag. of Nat. Hist., 2 ser., vol. xvi, pl. x, fig. 3, 1855.
— — *Otto Torell.* Bidrag till Spitsbergens Molluskfauna, p. 121, pl. iv, fig. 1.
— — *Jeffreys.* Br. Moll., vol. v, pl. xcix, fig. 3.
— — *Lovell Reeve.* Mon. of the Genus Terebratula, pl. vii, fig. 24.
— — *Dav.* Japanese Recent Brachiopoda, Proc. of the Zool. Soc. of London, pl. xxx, 1871.
— — *M'Andrew.* Annals and Mag. of Nat. Hist., vol. xvi, p. 465, 1855.

This species is now well known, and has been correctly described and illustrated. Mr. Jeffreys dredged a fresh and perfect specimen in 90 to 100 fathoms, about thirty-five miles north-north-west of Unst, but it occurs more plentifully in Spitzbergen. Specimens from Greenland (Collection Möller, in Museum of Copenhagen), in the Bay

of Biscay, at depths of from 292 to 539 fathoms. It was also dredged by Mr. A. Adams at Satanomosaki, Japan, in 55 fathoms. The shell has been found in the Post-Tertiary clays of Norway, and was first noticed by Sir C. Lyell in his paper on the rising of Sweden ('Phil. Trans.,' vol. for 1835, p. 36, pl. 2, figs. 32, 33), but without a specific denomination. Hisinger mistook it for *Terebratulina caput-serpentis* in 1837.

7. PLATIDIA ANOMIOIDES, *Scacchi*, sp. Dav., Introduction, p. 72, figs. 19, 20.

ORTHIS ANOMIOIDES (*Scacchi*), *Philippi*. Enum. Moll. Sicil., vol. ii, p. 69, pl. xviii, fig. 9.
MORRISIA — *Dav.*, &c.
PLATIDIA — *Costa*. Fauna del Regno di Napoli, p. 48, pl. iii, fig. 4, and pl. iii bis, fig. 6, 1852.

This shell was dredged by Mr. Jeffreys during the 'Porcupine' Expedition of 1869 at some little distance from the Shetland Islands, in 290 fathoms. It abounds in some parts of the Mediterranean and Ægean Seas, and has been found fossil in the Upper Pliocene rocks of Sicily.

8. GWYNIA CAPSULA, *Jeffreys*, sp. Dav., Supplement, Pl. I, figs. 3—4 *a*.

TEREBRATULA CAPSULA, *Jeffreys*. Annals and Mag. of Nat. Hist., 3rd series, vol. ii, p. 125, pl. v, fig. 4, 1859.
— — *L. Reeve*. Mon. of the Genus Terebratula, p. 10, fig. 39.
GWYNIA — *King*. Proc. Dub. Univ. Zool. Assoc., April, 1859, p. 258.
ARGIOPE — *Jeffreys*. Br. Conch., vol. ii, p. 21 ; vol. v, pl. xix, fig. 5.

Much has been written with reference to this minute shell, and different opinions have been expressed as to its generic position, but until its internal characters shall have been anatomically examined and made clear it would be unsafe to refer it with certainty to any of the described genera in particular. It is so minute, a mere speck so to say, that an examination of its interior is exceedingly difficult, and especially so in dried-up specimens. Dr. S. P. Woodward and myself spent a whole day at the British Museum on the 27th of April, 1859, in endeavouring, with the aid of a good microscope, to find some kind of calcareous support, but could find none, nor has any other naturalist who has studied the shell, been more successful. In 1859 Prof. King proposed for this shell the generic name of *Gwynia*, stating at the same time that "The principal generic character is in the labial appendages being attached directly to the shell [first observed by Mr. Jeffreys], and not to a loop, as in other genera of the family. The prominency of the umbone of the small or receiving valve, the form, position, and (considering the size of

the species) unusual development of its teeth, also the large size of the perforations of its shell-tissue, form other good distinguishing characters. We must not, however, for the present, assume that no calcareous support in reality exists."

Mr. Jeffreys differed from Prof. King with respect to the generic position of this species, and referred it to the genus *Argiope;* but I cannot help observing that in all the species of *Argiope* that have fallen under my observation a loop and septum or septa were present and visible, and for this reason I scarcely think we should be justified in placing it into Deslongchamp's well-characterised genus.

G. capsula is almost circular, or slightly elongated oval, nearly equivalved; beak slightly prominent; foramen triangular and large; shell thin, perforations rather large and far apart.

Mr. Jeffreys gives us the following habitats:—18 to 25 fathoms, Plymouth (Norman and Webster); Guernsey (Lukis); Dublin Bay and Portsmouth (Waller); Larne, Co. Antrim (Hyndman and Jeffreys). M. Colbeau obtained it from Sluys-Kill, Zelande, near the Belgian frontier. It occurs also fossil in the Post-Tertiary clays at Kirköen, near Christiania (Sars).

9. Argiope cistellula, *Wood.* Dav., Tert. Mon., Pl. I, fig. 2.

Megathyris cistellula, *Forbes* and *Hanley.* Hist. of Br. Moll., pl. lvii, fig. 9, 1849.
Cistella cistellula, *Dav.* Am. Journ. of Conch., vol. vi, 1870.
Argiope cistellula, *Jeffreys.* Br. Conch., vol. ii, p. 19, pl. i, fig. 2.

In the British Museum Catalogue of the Mollusca, part iv, p. 114, Dr. Gray proposed to divide the genus *Argiope* into two sections; that the name *Argiope* should be retained for those species the dorsal valve of which is interiorly provided with three or five radiating sub-marginal septa, and a four-lobed loop attached to the septa; while the name *Cistella* be given to those species such as the one under description, *A. Neapolitana,* &c., where there exists a single median sub-marginal septum and bilobed loop. M. Dall proposes that D'Orbigny's name *Megathyris* should be substituted for that of *Argiope,* the last name having been given by Savigny and Audouin in 1827 to a genus of Egyptian spiders.

At one time Mr. Jeffreys suggested that *A. cistellula* should be *A. lunifera,* Phillipi, but there seems to exist so much uncertainty with reference to Philippi's so-termed species that it will be advisable to retain Mr. J. Wood's name for the shell under description. I am glad to be able to state that Mr. Jeffreys now agrees to this arrangement, because it is evident to him that Philippi has confounded two species in his figures of *T. lunifera.* The smaller one probably is referable to the shell named *cistellula* by Wood, while the larger specimen belongs to another species.

Mr. Jeffreys gives the following habitats :—Orkneys, 35 to 40 fathoms (Thomas); East Shetland, Skye, Co. Antrim, Moray Firth (Dawson); Dublin Bay (Waller); Exmouth (Barlee and Clark); Guernsey (Lukis and Jeffreys). It occurs also in the Mediterranean. Fossil in the Pliocene.

10. ARGIOPE DECOLLATA, *Chemnitz*. Dav., Supplement, Pl. I, figs. 5, 5 *a*, and 6.

ANOMIA DECOLLATA, *Chemnitz*. Conch. Cab., viii, p. 96, pl. lxxviii, fig. 705.
ARGIOPE — *Jeffreys*. Brit. Conch., p. 18, vol. v, pl. xix, fig. 3, &c.

Mr. Jeffreys dredged a few specimens of this species two miles east of Guernsey in 18 fathoms, which, as he justly observes, is the most northern limit that has been discovered for the present species. In the Mediterranean it is a common shell at a depth of from 20 to 60 fathoms. On Adventure Bank in 92 fathoms.

A. decollata occurs fossil in the Pliocene rocks of Sicily, the south of France (Nice), and several other places.

11. ATRETIA GNOMON, *Jeffreys*. Dav., Supplement, Pl. I, figs. 7—10 *a*.

CRYPTOPORA GNOMON, *Jeffreys*. Nature, Dec. 2, p. 136, 1869.
ATRETIA — *Jeffreys*. Preliminary Report of the Scientific Exploration of the Deep Sea in H.M. Surveying Vessel 'Porcupine,' Proc. R. Soc., No. 121, p. 421, 1870.

Mr. Jeffreys obtained only a few imperfect specimens of this curious species, and consequently was unable to give a complete description. All he states is, that "Among the Mollusca were valves of an imperforate Brachiopod, with a septum in the lower valve, which we propose to name *Atretia gnomon*." Off the north coast of Ireland in 725 and 1443 fathoms.

I have, through the kindness of Mr. Jeffreys, been able to examine and, as it were, restore the shell from the fragments he had been able to assemble. One point only remained uncertain, namely, whether when perfect there were two little curved plates attached to the upper surface of the septum; for if such were the case then it would nearly agree with the *Mannia Nysti* of Dewalque, a fossil species from the 'Crag gris' or Étage Scaldisien of Antwerp, in Belgium. M. Dewalque did not publish any description of his shell, but named it as above in his 'Prodrome d'une description géologique de la Belgique,' p. 432, 1868. In *Atretia* the shell-structure is fibrous and without perforations, as in *Rhynchonella* (?); it will be more fully described by Mr. Jeffreys when more perfect material shall have been dredged.

12. RHYNCHONELLA PSITTACEA, *Chemnitz*, sp. Dav., Tert. Mon., Pl. I, fig. 7.

RHYNCHONELLA PSITTACEA, *Jeffreys.* Brit. Conch., vol. v, pl. xcix, fig. 4, &c.

Mr. Jeffreys is of opinion that this species inhabits the most northern parts of our seas. He dredged two perfect specimens off Unst, and detached valves have been obtained on more than one occasion. It is a common species in several northern seas, and lives in Finmark in 20 to 80 fathoms. Fossil specimens occur in Great Britain, Scandinavia, Canada, and other places. In vol. iv, p. 262, 1872, of the 'American Journal of Science and Arts,' Prof. Edward S. Morse states that he has recently been able to study *Rhynchonella psittacea* alive at Eastport, Maine, and to note the ciliary action in the oviducts driving currents outward, and to establish the correctness of Prof. Owen's supposition that the arms of *Rhynchonella* can be protruded.

From the above it will become apparent that some twelve species live at various distances from our shores in the British seas. Of these, nine occur fossil either in Post-Tertiary or Tertiary strata of different parts of the world; and it is probable, or at least possible, that the remaining three will be found so likewise upon further search.

BRITISH POST-TERTIARY BRACHIOPODA.

Although only two species of Brachiopoda have been hitherto recorded from the Post-Tertiary clays of Great Britain, seven have been found in similar deposits in Norway by the late Prof. Sars, Mr. J. G. Jeffreys, Mr. David Robertson, and Mr. Crosskey.[1]

[1] The Norwegian species will be found described in Prof. Sars' memoir entitled "Om de i Norge forekommende fossile Dyrelevninger fra Quartærperioden, et Bidrag til vor Faunas Historie," 1865, and in Messrs. Robertson and Crosskey's valuable paper, vol. vi of the 'Proceedings of the Philosophical Society of Glasgow.' The last-named gentlemen state that out of ten deposits examined by them six contained Brachiopoda, namely, Ommedalsstrard; near Skien; Sparebakken; Aafas, near Skien; Barhohmen, and Pladsen. The Norwegian species are *Terebratulina caput-serpentis, Waldheimia cranium, Wald. septigera, Terebratella Spitzbergensis, Gwynia capsula,* and *Rhynchonella psittacea. T. Spitzbergensis* was also found in glacial clays at Uddevalla and Christiania by Mr. Jeffreys and Prof. Sars. I have been able to examine those collected by Mr. D. Robertson.

1. Terebratulina caput-serpentis, *Linné.*

At p. 175 of Mr. Geikie's excellent "Memoir on the Glacial Drift of Scotland," in vol. i of the 'Trans. of the Geological Society of Glasgow,' this species is stated to have been found in the Post-Tertiary or Glacial clay of Ayrshire.

2. Rhynchonella psittacea, *Chemnitz.*

This species also has been quoted by Mr. Geikie as having been discovered in the Post-Tertiary clay of Ayrshire. It is stated by Mr. Jeffreys to occur in Post-glacial clay at March, in Caithness, and in a raised sea-bed between Larne and Glenarm, Co. Antrim, thirty feet above the present sea-level. It has been dredged in a fossil state near Shetland, Berwick, &c.; and is not rare, in separate valves, in the 'Mussel Clay' at Christiansand, thirty to forty feet above the sea.

SPECIES FROM THE DRIFT.

Several species of Brachiopoda have been met with in the Drift of Great Britain, but it has not always been possible to arrive at a positive conclusion as to the age of the rock whence these fossils have been derived. We refer more particularly to those that occur in the counties of Norfolk and Suffolk, and which are believed by some geologists to have been derived chiefly from the Lower Cretaceous and Upper Jurassic formations. I am not, however, aware of any rock *in sitû* in this country wherein these species have been actually discovered.

Terebratula ovoides, *Sow.* Dav., Supplement, Pl. I, figs. 12—13*a* (14, 15, 16?).

Terebratula ovoides et T. lata, *Sow.* Min. Conch, pl. c, figs. 1 and 2, August, 1815.
— — *Dav.* Brit. Oolitic Mon., pl. viii, figs. 4, 5 (not 6, 7, 8, 9, which refer to *Ter. trilineata*, Young and Bird).
— Rex, *E. Ray Lankester.* Geol. Mag., vol. vii, p. 410, figs. 1, 1*a*, 1870.

When I published my description of *T. ovoides*, Sow., in June, 1851, I had arrived at the correct conclusion that *Tereb. ovoides* and *T. lata*, Sow., from the Drift of Norfolk, were referable to a single species, but I committed a great mistake in placing Young and Bird's *Tereb. trilineata*, from the Inferior Oolite of Robin's Hood Bay, among the synonyms of Sowerby's shell. There exists a certain resemblance between some specimens of the two species, but it is possible to distinguish them by several features.

The discovery of my mistake is due to Mr. Lankester and Mr. Walker, and I feel much indebted to those two gentlemen for having put me on the right track.

The boulders in which *Ter. ovoides* occurs are, as stated by Mr. James Sowerby, "a sandstone containing green sand," and very different in colour and composition from the rock which, at Peak and Glaizedale, near Whitby, contains the *Ter. trilineata* of Young and Bird.

Sowerby's figure of *T. ovoides* is not very good, and the three-quarter view in which the shell is drawn is an unfavorable position.

Terebratula ovoides is longer than wide; and its greatest breadth is at the posterior half of the shell, whence the sides gradually taper to the small rounded front. In *Ter. trilineata* the shell is comparatively less elongated, more irregularly oval or ovate. Again, in *T. ovoides* the ventral valve is very convex and longitudinally keeled; while in *T. trilineata* the same valve is more regularly rounded. The dorsal valve is also deeper and more uniformly convex in the last-named shell, the same valve being much more flattened and slightly depressed along the middle in the Sowerbian species. In well-preserved examples of *T. ovoides* we likewise observe indications of slightly marked radiating lines, which are intersected at various intervals by more or less deeply marked concentric lines of growth.[1]

There exists also a considerable difference in the respective proportions attained by the two species. Thus, for example, the largest specimen of *T. ovoides* that has fallen under my notice measured $3\frac{3}{8}$ inches in length by $2\frac{3}{8}$ inches in breadth and $1\frac{2}{8}$ inch in depth; whilst the largest *T. trilineata* did not much exceed, as far as I am aware, 2 inches in length by $1\frac{5}{8}$ inch in breadth and $1\frac{1}{8}$ inch in depth.

Terebratula ovoides cannot be confounded with *Tereb. homologastyr*, from the 'Brown

[1] In his paper "On a new large Terebratula occurring in East Anglia," published in the 'Geol. Mag.,' vol. vii, p. 410, Sept., 1870, Mr. E. R. Lankester expresses the opinion that the large Terebratula drawn as fig. 1 on his plate, and reproduced in our Pl. I, fig. 13, has the general simple form of *T. ovoides*, but is remarkable for its great size; that the imperforate valve is flattened on the mesial line, whilst the perforate valve is deep and raised into a well-pronounced keel in the mesial line, extending from the beak; the foramen being likewise small. To this form he has given the name of *Rex*, and although I will not positively assert that it may not be specifically distinct from *T. ovoides*, my impression is that it is only a very large example of Sowerby's species.

Jura' of Bopfingen, Würtemberg, although it has been stated that some specimens referable to that species have been met with in the Drift of Norfolk.

Erratic blocks containing *T. ovoides* have been picked up in the Drift of several parts of Norfolk and Suffolk, especially at Gisleham, near Lowestoft, and Thorpe in Suffolk; Stow Bardolph, Downham; Roslyn Pit, Ely;[1] Feltwell, Norfolk, &c.

It has also been stated by Mr. R. Lankester that at least some of the derived, rolled, and water-worn internal casts (Pl. I, figs. 15, 16) that occur in the Lower Greensand at Upware are likewise referable to *T. ovoides;* and it is possible that such may be the case, although some of the specimens are comparatively broader and shorter than in the typical forms of Sowerby's species, as found in the Drift of Suffolk.

As to the geological age of *T. ovoides,* considerable uncertainty must still prevail, although Mr. Lankester has informed us, in his valuable paper already quoted, that Mr. Seeley has found a rock *in sitû* beneath the bed of the Cam, between Ely and Upware, and which would agree in stratigraphical position with the very highest of the Oolites. Its relation, however, to this rock requires further confirmation.

Besides *T. ovoides,* a large and very convex *Terebratula* (Pl. I, fig. 17) was found by Mr. C. B. Rose in the Drift of North Pickenham; and I possess a block of sandstone from the Drift of the same county, containing *L. ovalis,* as well as a species of *Discina.* Several very much worn and rolled specimens of Jurassic and Cretaceous *Rhynchonellæ* have also been obtained, by Mr. Walker, from among the derived fossils occurring in the Lower Greensand at Upware and Potton, which require to be carefully studied.

SUPPLEMENT TO THE BRITISH TERTIARY BRACHIOPODA.

Athough twenty-three years have elapsed since the publication of my 'Monograph of British Tertiary Brachiopoda' not a single new species has been discovered, and, indeed, of several of those I have described in 1852 no specimen has been again collected.

With the exception of *Lingula tenuis, Terebratulina striatula,* and *Terebratula grandis,* all the other forms remain extremely rare.

In France, Belgium, Germany, and Switzerland, Tertiary Brachiopoda are likewise specifically few in number; and, if we except *Terebratula grandis* and three or four others, the species of that period are scarcely obtainable. In Italy, on the contrary, Tertiary

[1] For an account of the Roslyn or Roswell Pit, near Ely, see 'Geol. Mag.,' vol. i, 1864, Mr. Seeley, p. 150; and vol. v, 1868, p. 347; *ibid.*, Rev. O. Fisher, pp. 407 and 438; and vol. ix, 1872, Rev. T. G. Bonney, p. 403.

Brachiopoda are both specifically and individually numerous.[1] Those from Spain and from other parts of the world have not yet been sufficiently collected and studied. Several very interesting species have been found in Australia, especially at Mount Gambier, by the Rev. J. E. Woods. In that locality occurs the shell I described in the 'Geologist' for December, 1862 (vol. vi, p. 446, pl. xxiv, fig. 19), under the designation of *Waldheimia Garibaldiana,* and at the time erroneously believed to have been found in the Island of Malta. It occurs in company with *T. compta.*

I should scarcely have considered it necessary to have referred again to this portion of my work, since Mr. S. Wood has also completed his admirable Monograph, published by the Palæontographical Society, by a description of the Brachiopoda from the Crag, had I not determined to add to my Supplement everything that could not be stated in the already published work.

1. Lingula tenuis, *Sow.* Dav., Tert. Mon., Pl. I, fig. 12; and Appendix, Pl. A, figs. 3, 4, 5; Supplement, Pl. II, figs. 6—8.

Subsequent to the publication of my description and figures of this species many very fine examples have been found by Mr. C. J. H. Meÿer in the London Clay (Bognor series) during the excavating of the new docks at Portsmouth. These show that when quite perfect the shell was broadest near the beak, and from that point tapered gradually towards the front, this last-named portion of the shell being either nearly straight or gently rounded. Young specimens and a dwarf variety have been likewise discovered by Mr. Meÿer, rather plentifully, in the upper parts of the London Clay at Sydenham Hill, near London. This last is almost regularly oval, its greatest breadth being near the beak.

In vol. xxvii, p. 76, of the 'Quarterly Journal of the Geological Society,' Mr. Meÿer describes the bed wherein the *Lingulæ* occur as the "*Sands with Lingula.*" Some of the specimens attained seven lines in length by three in breadth, and the sides are in some examples remarkably sub-parallel during the greater portion of their length. The largest specimen of *L. tenuis* that has come under my notice slightly exceeded half an inch in length, by a little less that a quarter of an inch in breadth.

Mr. Wetherell informs me that *L. tenuis* is rare at Highgate Archway, that it was found in the Well at the Lower Heath, Hampstead;[2] also at Child's Hill, near Hampstead; Finchley; Brentwood; Cuffell; Nunsham; Bognor, &c.

[1] In vol. vii of the 'Geol. Magazine,' 1870, I described and figured fifty-eight species of Italian Tertiary Brachiopoda, and since that period Prof. Seguenza has discovered several others.

[2] Trans. Geol. Soc., London, sec. 2, vol. v, p. 131.

2. Lingula Dumortieri, *Nyst.* Dav., Tert. Mon., Pl. I, figs. 10, 11; Supplement, Pl. II, fig. 9.

Lingula Dumortieri, *S. Wood.* Sup. to Crag Mollusca, Pal. Soc., p. 172, pl. xi, figs. 1, 1 *a*, *b*, *c*, 1874.

No complete example of this species has been hitherto found in Great Britain; and scarcely ever even in Belgium, where the shell is not quite as rare. Some specimens from the Grey and Yellow Crag, or "Étage Scaldisien," at Stenÿvenberg, in the neighbourhood of Antwerp, have measured one inch and a quarter in length, by a little more than half an inch in breadth.

Mr. Jeffreys is of opinion that this *Lingula* cannot be specifically distinguished from the *Lingula jaspidea* of A. Adams, dredged in seven fathoms at Mososeki, in Japan; but, as only one small example of the recent form could be examined, this supposed identification must for the present remain an open question.

Lingula Dumortieri, when in life, presented, there can be but little doubt, a bright brownish or somewhat coppery colour, such as is seen in *L. jaspidea* and in a larger form of the same genus which occurs in the Bay of Jeddo, Japan.

Position and Localities.—Coralline Crag, Sutton and near Orford.

3. Discina fallens, *S. Wood.* Dav., Tert. Mon., Pl. I, fig. 9.

Discina Norvegica? *S. Wood.* Ann. and Mag. Nat. Hist., p. 253, 1840.
Orbicula lamellosa? *Dav.* Tert. Mon., pl. i, fig. 9 (not of Broderip), 1852.
Crania Atlantica, *Bell.* Proc. Geol. Association, vol. ii, p. 206, 1872 (not *Discina Atlantica*, King).
Discina fallens, *S. Wood.* Sup. to the Crag Mollusca, p. 172, pl. xi, fig. 6, 1874.

Two small examples only were found by Mr. S. Wood. The specimen described by myself in 1852 is in the British Museum, and was carefully examined and compared with *Discina Atlantica* by Prof. W. King, in 1867, who states, in the Proceedings of the Natural History Society of Dublin, January 2, 1868, "At one time I entertained a suspicion that the shell herein described (*D. Atlantica*) might turn out to be specifically identical with the Crag specimen; but having lately examined the latter in the British Museum, I find that the present species (*D. Atlantica*) has a more circular form, seemingly finer lines of growth, also more elevated and less excentrically situated apex." It is certainly not a *Crania*, as suggested by Mr. Bell in his paper on the English Crags. Mr. Wood's second example is larger than the one figured in my Monograph. It is three lines in length by two and a half in breadth. Mr. Wood has proposed the specific name of *fallens* for the Crag species, which I willingly adopt.

4. TEREBRATULINA CAPUT-SERPENTIS, *Linné.* Dav., Tert. Mon., Pl. I, figs. 14, 15.

TEREBRATULINA CAPUT-SERPENTIS, *S. Wood.* Sup. to the Crag Mollusca, p. 168, pl. xi, fig. 3, 1874.

I have nothing new to add. It occurs but very rarely in the 'Crag noir' or 'Système Diestien' of Belgium. In England it is found in the Coralline Crag at Sutton, where it is stated by Mr. S. Wood to be very rare; and indeed very small and young individuals only have been obtained.

5. TEREBRATULINA STRIATULA, *Sow.* Dav., Tert. Mon., Pl. I, fig. 16.

Mr. Wetherell informs me that *T. striatula* has been found in the following localities:—Finchley, near Highgate; in the well at the Lower Heath, Hampstead; near Cuffell, Nunsham, &c. Prof. Morris, in his 'Catalogue,' second edition, p. 160, 1854, gives Highgate as a locality; but Mr. Wetherell considers that this species belongs to a much lower zone than that of Highgate in the London Clay. In a paper "Observations on some of the Fossils of the London Clay, and in particular those organic remains which have been recently discovered in the Tunnel for the London and Birmingham Railway at Primrose Hill," 'Phil. Mag.' ser. 3rd, vol. ix, p. 462, 1836, Mr. Wetherell gives the names of several fossils which he considered to be characteristic of three zones, viz. Upper (as at Highgate), Middle, and Lower; and *T. striatula* he names as belonging to the last. Specimens have been found likewise by Mr. Meÿer in a mass of London Clay thrown up from a considerable depth during the excavations of the London and Chatham Railway. It is not rare in the Island of Sheppey, but the specimens found there are not often in a good state of preservation. *T. striatula* occurs in the 'Étage Landenien supérieur,' = 'Woolwich and Reading Series' of Prestwich.

6. TEREBRATULA BISINUATA, *Lamarck.* Dav., Tert. Mon., Pl. I, fig. 17 (?); and Appendix, Pl. A, fig. 2.

This species continues to be exceedingly rare. I know of but two well-authenticated British examples—the one in the collection of Mr. Cunningham, and the other in that of Mr. J. F. Walker, of York; both of these were found in the Eocene Clay of Barton Cliff in Hampshire. I am very uncertain whether the specimen figured in Pl. I really belongs to the Lamarckian species: I much fear that it does not.

The species is equally rare in Belgium. One specimen was found by M. Vincent in the Lower Laeckenian Sands of Dieghem, near Brussels, and another by the late Dr. Stacquey in beds of a similar age at Gand. M. Nyst informs me that they are the only examples hitherto discovered. In France, on the contrary, it has been often found in the Lower and Middle Calcaire Grossier at Grignon, Parnes, Mouchy, Chaumont, Le Vevray, Les Groux, Chaussy, Vaudancourt. Also at Biarritz, Mont Alaric, Maigon, Fabrezan (Pyrenees), and at Kressemberg in Bavaria. It has been well described by M. Deshayes at p. 145 of the Supplement to his 'Coquilles fossiles des Environs de Paris.'

7. Terebratula grandis, *Blum.* Dav., Supplement, Pl. II, figs. 1—4.

Terebratula grandis, *Dav.* Tert. Mon., p. 16, pl. i, fig. 18; pl. ii, fig. 8; 1852.
— — *S. Wood.* Sup. to the Crag Mollusca, p. 168, pl. xi, fig. 5 *a*—*g*; from the Cor. Crag, Sup., pl. viii, fig. 11 *a*—*c*; from the Red Crag, 1874.

The exterior and muscular impressions have been fully described and illustrated in my Monograph and elsewhere; but formerly I was not acquainted with the complete apophysary system or loop. In June, 1861, M. E. Deslongchamps was able to develop the entire loop from a French specimen obtained by him from the neighbourhood of Nantes, and of which he published an excellent illustration in his 'Études critiques sur des Brachiopodes nouveaux ou peu connus,' pl. viii, figs. 15, 16, Caen, August, 1869. Early in 1862 Mr. S. Wood and Dr. S. P. Woodward were able to work out the complete loop, with its long slender crura, of a large specimen that had been obtained by the former from the Coralline Crag of Ramsholt. Of this specimen, now in the British Museum, a figure will be found in Pl. II of this Supplement. A drawing of the loop has likewise been given by Quenstedt in his 'Petrefactenkunde Deutschlands; Brachiopoden,' pl. xlviii, fig. 23, 1871.

Some ten examples with the loop complete have also been found by M. Nyst in the Crag of Belgium; and, in addition to these, I may mention that Mr. A. Bell has obtained from the Red Crag of Waldringfield, near Woodbridge, a large number of perfect bivalve specimens, with a rather more globose or elongated shape than is usual with those specimens that occur in the Coralline Crag. In the Red Crag variety, which does not appear to have attained the dimensions of the Cor. Crag species, the lines of growth are strongly marked and projecting in some examples; but the loop and muscular impressions, which I was able to develop, entirely agree with those observable in the specimens found in the Coralline Crag. *T. grandis* has been also obtained from the Cor. Crag of Sutton and near Orford, and in the Red Crag of Walton-on-the-Naze and

Sutton, where specimens from one line in length to upwards of five inches may be collected.

T. grandis is the most abundant of all the Tertiary species in England, France, Belgium, and Germany. It is found also in Italy and Spain. A shell- or Terebratula-breccia, detached by Captain Brome from a hewn block that constituted part of an old Moorish fort at Gibraltar, and given by him to Prof. Busk, contains *Ter. grandis* in great abundance, *T. vitrea*, *Rh. psittacea*, and other shells. This shell-rock was probably once a portion of one of the old raised sea-beaches attached to the eastern face of the Rock of Gibraltar. *T. grandis* varies a good deal in shape, for while some specimens are uniformly convex, others are somewhat biplicated.

In Belgium *T. grandis* is stated by M. Nyst to occur in the 'Étage Scaldisien' (Sables gris à Bryozoaires) at Antwerp, and, according to the same Palæontologist, perhaps likewise in the 'Étage Diestien' Dumont (= Upper Miocene) at Fort De Vieux Dieux, Antwerp. In M. Dewalque's 'Prodrome de Géologie' M. Bosquet quotes the shell from the 'Terrain Tongrien inférieur' of Limburg; but M. Bosquet has recently informed me by letter that his identification is more than doubtful, and that there exists no positive evidence of the shell having been found in that formation.

8. Argiope cistellula, *S. Wood.* Dav., Tert. Mon., Pl. I, fig. 13.

Argiope cistellula, *S. Wood.* Sup. to the Crag Mollusca, p. 170, pl. xi, fig. 4 *a—d*, 1874.

Always very rare in the Coralline Crag, Sutton.

9. Rhynchonella psittacea, *Chemnitz.* Dav., Tert. Mon., Pl. I, fig. 19; and Sup., Pl. II, fig. 5.

Rhynchonella psittacea, *S. Wood.* Sup. to the Crag Mollusca, p. 170, pl. xi, fig. 4 *a—d*, 1874.

This species has been recorded by Mr. A. Bell from the Red Crag of Sutton ('Annals and Mag. of Nat. Hist.,' September, 1870), where it attained large dimensions.

It is mentioned by Mr. S. Wood from the Fluvio-marine Crag of Bramerton, Thorpe, and Postwick; Chillesford bed, Bramerton; Upper Glacial, Bridlington; Post-glacial, March. It has also been met with in the Crag in the neighbourhood of Antwerp, in Belgium, but there, as with us, it is very rare.

SUPPLEMENT TO THE BRITISH CRETACEOUS BRACHIOPODA.

Eighteen years have elapsed since the publication of my 'Monograph of British Cretaceous Brachiopoda.' The first part appeared in August, 1852; the second and concluding part in May, 1855.

In the mean time many geologists and palæontologists have been hard at work in this country and on the Continent, studying the stratigraphical succession of the numerous deposits of which the Cretaceous System is composed, as well as the organic remains they contain. A very large mass of additional and valuable information has thus been gained to science since 1855; and this will necessitate some alterations and considerable additions to the Monograph, which in 1855 had been made as complete as it was then possible to make it with the information and material in our possession. In the 'Geological Magazine,' vol. vi, 1869, I endeavoured to assemble and publish the principal views entertained by foreign geologists with regard to the divisions of the Cretaceous System; and it will be there seen that, although they differ to some extent with respect to the number of the divisions into which the "system" should be separated, they are all very much of the same mind with reference to the order of sequence generally.

In no single locality can we expect to find the succession complete, or representing all the local phases which certain divisions will assume in one or another locality; so that it is sometimes difficult to correlate the beds occurring in one country with those found in another, and especially so for widely separated districts.

Since my Monograph was published many geologists,—among whom we may name Messrs. Hébert, Cornuel, Coquand, Lory, Tombeck, Pictet, Vélain, De Loriol, Zittel, Schloenbach, Strombeck, Gümbel, Credner, Geinitz, and others on the Continent,—Messrs. Godwin-Austen, Judd, Topley, Meÿer, Walker, Seeley, R. Tate, Caleb Evans, Wiltshire, Morris, Etheridge, Whitaker, R. Lankester, M. Norman, and some others in this country, have powerfully contributed towards the advancement of our knowledge upon this subject; but there remains still much to be done before geologists will have become quite unanimous in their terminology or as to the number and value of all the divisions they respectively propose. I will briefly point out some of the improvements effected in the divisions of our British Cretaceous System, which affect, to a great extent, the distribution and localisation of the species forming the subject of this Monograph.

In 1852 we divided the Cretaceous System of Great Britain, according to the ideas then prevalent, into *Upper Chalk, Lower Chalk, Chalk-marl, Chloritic Marl, Upper Greensand, Red Chalk, Speeton Clay, Gault,* and *Lower Greensand;* but a comparison of our series with that which prevails upon the Continent made it soon apparent that several subdivisions or beds, which occur in other countries, are wanting in Great Britain. Geologists appear, however, unanimous in separating the Cretaceous System into two great divisions; the base of the Gault being considered the line of demarcation dividing the upper from the lower portion of the system.

The uppermost beds of the Cretaceous System, comprising the "Étage Garumnien" of Leymerie, Pisolitic Limestone, Yellow Chalk of Maestricht, Limestone of Faxoe and Limsteen, the Grey Chalk of Ciply, Limestone of Salthom, including M. Coquand's "Étage Dordonien," and the upper part of the "Sénonien" of D'Orbigny, as well as the Limestone with Baculites of Valogne and the Chalk of Ignaberga, &c., appear to be wanting in Great Britain.

1. In England, in the descending series, we begin with the *Upper* or *Norwich Chalk,* with *Belemnitella mucronata, Ostrea vesicularis, Terebratula carnea, Magas pumilus,* &c. It represents M. Coquand's "Étage Campanien," and may be seen at Norwich, Charlton, Antrim in Ireland, at Meudon, near Paris, and at many other places.

2. *Lower Chalk* (upper portion).—A Chalk much resembling the preceding, but harder and usually known by the designation of "Chalk with flints." Among its numerous fossils we may mention *Micraster cor-anguinum* and *Terebratula semiglobosa.* It corresponds to the "Sénonien" of D'Orbigny, "Santonien" of Coquand, and may be seen at Lewes near Brighton, Dover, Hinton, and other places. Between this and the next division there occurs upon the Continent several large deposits which are wanting in England.

3. *Lower Chalk* (lower portion) with *Micraster cor-testudinarium,* having for its base the zone of *Holaster planus.* This may be seen at Dover, near Lewes, &c. M. Hébert, in a paper read before the Brighton Meeting of the British Association in August, 1872, objected, with much reason, to the terms "Chalk with" and "without flints" being made use of, from flints occurring both in the Upper and Lower Chalk.

4. *Chalk-marl,* or Chalk with *Inoceramus labiatus.*—This formation, which at Watlington, Oxon, cannot be less than from fifty to sixty feet in thickness, occurs at Glynde, near Lewes, and in other places.

5. *Upper Greensand.*—This division should be subdivided, for it comprises several important formations which have not yet been sufficiently defined, namely, the Chloritic Marl of Chard, Chardstock, &c.; the Greensand and Sandstone of Warminster; Greensand of Cambridge (Upper Gault or "Étage Vraconien" of Swiss geologists).

The "Hibernian Greensand" of Ireland is considered by Mr. R. Tate to represent

the Upper Greensand, the Chalk-marl, and the lower part of the Lower Chalk of England (?).

The Red Chalk of Hunstanton has been considered by some geologists to represent the Upper Gault, and at any rate it seems by its fossils to be nearly connected with that formation. The Rev. T. Wiltshire, in his excellent paper on the Red Chalk of England, suggests that "probably it is better to regard it as an intermediate formation between the Lower Greensand and Lower Chalk which comes into being when the Gault and Upper Greensand have almost thinned out."

6. The *Gault* of Folkestone and Wissant, as above stated, forms the base of the upper half of the Cretaceous System.

The second or lower division, as it occurs in England, has been the subject of considerable discussion and research by Messrs. Judd and Meÿer.

Mr. Judd objects entirely to the name "Lower Greensand" as applied by English geologists to all the Cretaceous beds that occur under the Gault, and advocates the dividing of this portion of the system into *Upper Neocomian* ("Aptien," D'Orb.), *Middle Neocomian* ("Urgonien," D'Orb., "Barrémien," Coquand), and *Lower Neocomian;* but it is not quite clear to me that we possess in England the Lower Neocomian as found on the Continent.

Mr. Judd states at p. 241 of the 'Quart. Journal Geol. Soc.,' vol. xxiv, 1868, "The Speeton Clay contains at least seven divisions, well marked lithologically, still better defined palæontologically. They are, 1st, the Upper Neocomian, having its equivalent in the Lower Greensand of the South of England; 2nd, the Middle Neocomian, of which the Tealby series of Lincolnshire is the equivalent; 3rd, the Lower Neocomian, now recognised for the first time in this country." The remaining five divisions of the so-called Speeton Clay should be classed, according to the same author, in the Portland and Kimmeridge, or upper portion of the Jurassic system.

Mr. Meÿer, in his notes on the correlation of the Cretaceous rocks of the south, east, and west of England ('Geol. Mag.,' vol. iii, 1866), and Mr. Topley, in his paper on "The Agricultural Geology of the Weald" (1872), follow the Geological Survey in dividing the Lower Greensand (in ascending order) into *Atherfield clay, Hythe beds, Sandgate beds*, and *Folkestone beds.* Mr. Meÿer describes these beds as follows :

"1. The lowest subdivision of the Greensand, the Atherfield Clay of Fitton, and Lower Neocomian (in part) of foreign authors, is known to occur beneath the Kentish-rag series of Folkestone, although unexposed in the coast section, and its continuity has been traced inland past Maidstone, Sevenoaks, Redhill, and Guildford. It is visible on the shore beneath Redcliffe, and still more conspicuously at Atherfield, in the Isle of Wight, westward of which it scarcely appears to have extended. The thickness and mineral composition of this group is very uniform throughout its course, consisting in its lowest layers of sandy clay, which, where the fossils are most abundant, has become consolidated into hard, nodular concretions of shell-rock. A stiff brown or bluish clay (the

'Lobster-clay' of Atherfield) prevails throughout its middle portion, becoming gradually more arenaceous in its passage upwards.

"2. The Hythe beds (the Kentish-rag series of Fitton) are well exposed in the vicinity of Hythe, and in the famous quarries at Maidstone; and may also be observed at Sevenoaks, and at Bletchingley, near Nutfield. To the westward of Nutfield these beds alter their character so considerably as to be no longer recognizable; the regular beds of limestone and hassock so conspicuous at Hythe and Maidstone being replaced by sand-rock and chert, as at Leith Hill, or almost entirely by sand, as at Guildford and Godalming. The argillo-arenaceous deposits, which in the Isle of Wight represent the Hythe beds, are also devoid of stone; unless we include in this division the 'Crackers-rock' of the Atherfield section, which appears, however, to belong more properly to the lower division, and is so placed in my section. It is worthy of remark that the numerous fossil Mollusca of the Crackers-rock occur at East Shalford (in Surrey) on nearly the same level as the Perna-bed and *below* the principal clay bed, instead of above it as at Atherfield.

"3. The Hythe Beds are succeeded in the vicinity of Folkestone by a deposit of dark-coloured argillaceous sand, from 140 to 150 feet in thickness, geologically known as the 'Sandgate beds,' and representing the 'Middle or argillaceous division' of Fitton. The outcrop of this bed is very conspicuous on the shore between Folkestone and Sandgate, where it forms a low and ugly cliff of a blackish-green colour, and its presence may be traced westward for a considerable distance. . . . . The Sandgate, like the Hythe beds, appear, in fact, to lose their distinctive features in passing westward, the two series gradually coalescing, and becoming thereby almost indistinguishable.

"In the Isle of Wight the Sandgate and Hythe beds may be best observed in the coast-section between Dunnose Point and the middle of Sandown Bay. The former appearing to be represented by blackish-green strata which rise on the shore beneath Knock Cliff, and which, traversing the lower part of Shanklin and the upper part of Small Hope Chines, continue visible in the cliffs as far as Little Stairs Point; the cliffs thence to Sandown being almost entirely occupied by the representative of the Kentish-rag series.

"4. The Folkestone beds, the series next in order of succession, and which constitute the 'ferruginous or Upper division' of Fitton, although including in their inland course a somewhat complicated series of deposits, exhibit in the Folkestone section but little variation in mineral character, the strata consisting almost entirely of light-coloured sands with irregular concretions of siliceous sandstone. . . . . "

It is therefore evident that, although we may not possess in this country either the highest or very lowest beds of the Cretaceous System, and though several important Continental intervening divisions are wanting, still, our Cretaceous series is very important, as far as it goes. It is represented both in Ireland and in Scotland; but does not in either of the last two portions of the United Kingdom assume the importance it does in the south and middle of England.

We must now hasten to point out some important general modifications to be effected to the published portion of our Monograph.

It is stated at p. 107 that, "according to the generality of British geologists, the *Faringdon Sponge-gravel* would belong to the age of the Lower Greensand, by myself to that of the *Upper Greensand* or *Tourtia,* and by Mr. Sharpe to the *Upper Maestricht* beds." It now appears from the minute and able investigations by Mr. Meÿer that the generality of British geologists were correct, and that both Mr. Sharpe and myself were mistaken. Consequently all the species described by myself in 1852 and 1855, from the "Sponge-gravel" of Faringdon, will have to be considered of the age of the Lower Greensand. What misled me was finding in the Sponge-gravel above named so many of the Tourtia forms, and the Tourtia having been considered by several foreign geologists to be newer than the Gault; and, indeed, the exact geological position of that Belgian deposit seems still to remain an open question.

The Speeton Clay had also been placed above the Gault, while it has since been shown by Mr. Judd to be older than that formation.

The important discovery of the Upware and Potton beds, and their numerous Brachiopoda, by Messrs. Walker, Seeley, Keeping, Earwaker, and others, as well as of the Tealby series by Mr. Judd, and the important investigations among the Cretaceous deposits of the south-east and west of England by Mr. Meÿer and Mr. R. Lankester, in addition to those by Mr. R. Tate in Ireland, have brought to light many species unknown when I published my Monograph, and which will necessitate a somewhat lengthened Supplement.

Messrs. Meÿer, Walker, Judd, R. Tate, and several others to be named in the sequel, have afforded me much assistance and information, for which I now beg to tender them my warmest acknowledgment.

Mr. Judd's important discovery of Upper Greensand and Chalk-with-flints in the Isle of Mull is one of the most recent additions to our knowledge. Few Brachiopoda, however, have been detected in the Cretaceous rocks of Scotland, some are quoted by Messrs. Salter and Ferguson from the drifted Chalk-flints of Aberdeenshire, *Crania costata,* Sow., *Terebratula,* sp., *Kingena lima,* Defr., *Rhynchonella Mantelliana,* Sow.; and *Rh. compressa,* Lam., from the Upper Greensand of Moreseat, in the same county; 'Quart. Jour. Geol. Soc.,' vol. xiii, p. 85.

1. Lingula truncata, *Sow.* Dav., Cret. Mon., Pl. I, figs. 27, 28, and 31.

Nothing new. Specimens from Lower Greensand of Shanklin, Hythe, Pease-marsh, Faringdon (Meÿer).

2. Lingula sub-ovalis, *Dav.* Cret. Mon., Pl. I, figs. 29, 30.

Nothing new. It seems to be rare.

3. Crania parisiensis, *Def.* Dav., Cret. Mon., Pl. I, figs. 1—7.

Specimens from Lower Chalk, Croydon.

4. Crania ignabergensis, *Retzius.* Dav., Cret. Mon., Pl. I, figs. 8—14.

Specimens from Upper Chalk, of Charlton; Lower Chalk, Guildford, Croydon; Chloritic Marl, of Pinhay Cliff (Meÿer).

5. Crania irregularis? *Roemer.* Dav., Cret. Mon., Pl. XII, figs. 40, 41—not *Crania cenomanensis,* D'Orbigny, Dav., Cret. Mon., p. 103. *Crania irregularis,* Roemer, Oolithengebirge II, 23, pl. 18, fig. 1.

Mr. Meÿer doubts the correctness of my identification of this shell with the *Crania cenomanensis* of D'Orb., and would refer it to the *C. irregularis* of Roemer. This, as well as the other Faringdon species, will now have to be referred to the age of the Lower Greensand or Upper Neocomian.

6. Crania cenomanensis ? *D'Orb.*

Mr. Meÿer has some imperfect specimens of a *Crania* from the Chloritic Marl of Dunscombe Cliff, near Sidmouth, which may, perhaps, be referable to the above-named species.

I have also observed on a specimen of *T. capillata,* from the Red Chalk of Hunstanton, in the collection of the Rev. T. Wiltshire, a small attached valve of a *Crania* somewhat resembling *C. cenomanensis,* Supplement, Pl. II, figs. 10 and 10 *a.* The muscular impressions were, however, too faintly marked to enable me to feel certain as to its identification.

7. Thecidium Wetherelli, *Morris.* Dav., Cret. Mon., Pl. I, figs. 15—26 (not Pl. XII, fig. 39).

The lamellar processes seen under the beak of the ventral valve are sometimes

remarkably parallel in their arrangement. The species occurs often in the Upper Chalk of Grays and Charlton, also in the Lower Chalk of Guildford and Croydon.

8. Thecidium Faringdonense, *Meÿer,* MS. Dav., Sup., Pl. II, figs. 11, 11 *a*, 12 *a*.

Thecidium Wetherelli, *Dav.* (Not of Morris.) Cret. Mon., pl. xii, fig. 39.

In external shape and dimensions this species seems nearly allied to the preceding one. It differs, however, in the more elongated form of the attached valve and in the arrangement of the lamellar processes. In the interior of the smaller or dorsal valve there appear to exist some small differences which would help to distinguish it from *Th. Wetherelli,* but I have not been able to procure specimens sufficiently perfect to enable me to make out all its characters. It is very abundant in the Sponge-gravel at Faringdon.

Mr. Meÿer has likewise discovered some very transverse attached valves, of perhaps another species, in the Chloritic Marl (or top of Upper Greensand) at Dunscombe Cliff, between Sidmouth and Beer Head, but not sufficiently perfect to admit of specific determination.

9. Argiope Bronni, *von Hag.* Dav., Cret. Mon., Pl. III, figs. 1—13, and Pl. XII, figs. 37, 38.

Argiope decemcostata (*Roem.*), *Dav.* Cret. Mon., p. 16, pl. iii, figs. 1—13.

Dr. Schloenbach would refer figs. 8 and 9 to *A. Buchii,* von Hag., and figs. 1, 7, 12, and 13 to *A. Bronni,* of the same palæontologist. I am, however, very much disposed to believe them all referable to a single species, although Pl. XII, fig. 37, represents the original figure of von Hagenow's *A. Bronni,* while fig. 38 illustrates his *A. Buchii.* When one examines a number of specimens they seem to graduate one into the other, so that, unless we deal only with typical examples, the intermediate forms could scarcely be referred more correctly to one than to the other.

10. Argiope megatrema, *Sow.* Dav., Cret. Mon., Pl. XII, figs. 31, 32, and 34—36.

Dr. Schloenbach seems disposed to refer figs. 35 and 36 to *A. decemcostata,* Roemer, while admitting that figs. 31, 32, and 34 represent *A. megatrema;* but I am not

convinced that we have two species; and *A. decemcostata* may perhaps be a synonym of *megatrema*.

We may mention that an incomplete ventral valve of an *Argiope,* much resembling the one under description, has been found by the Rev. J. F. Blake in the Red Chalk of Hunstanton.

11. Magas pumilus, *Sow.* Dav., Cret. Mon., Pl. II, figs. 1—12 and 33.

Specimens from Charlton, Kent. Upper Chalk.

12. Magas? Geinitzi, *Schloenbach.*

Magas Geinitzi, *Schloenbach.* Beiträge zur Paläontologie der Jura und Kreide-Formation im nordwestlichen Deutschland, Abdruck aus 'Palæontographica,' p. 32, pl. xxxix, fig. 48.

Mr. Meÿer obtained a small shell from the Chloritic Marl of Dunscombe Cliff (west of Beer) which he believes to agree very well with Schloenbach's figures, but he could not get at the interior. In shape it is slightly longitudinally oval, with a small depression in front. The surface is covered with small granulations or punctures, and is marked with a few concentric lines of growth. It measures $3\frac{1}{2}$ lines in length, by 3 in width, and 2 in depth.

I know so very little of the so-termed *Magas? Geinitzi* that I can offer no opinion with respect to the identification; nor am I at all certain that Schloenbach was correct in referring his genus to *Magas.* This identification is, therefore, quite provisional and even doubtful, and is given simply for the sake of reference. Schloenbach's specimens are from the Étage Cenomanien of Essen, in Westphalia.

13. Terebratella Menardi, *Lamarck.* Dav., Cret. Mon., Pl. III, fig. 42; and Sup., Pl. VIII, fig. 14.

Mr. Meÿer is of opinion that *T. Menardi,* Lamarck, and *T. truncata,* Sow., should be considered as specifically distinct. The only difference I can perceive between the two is that the Lamarckian species is rather longer and a little more transverse; its ribs are likewise somewhat sharper.

I have a specimen from the Chloritic Marl of Chardstock, Pl. VIII, fig. 14, agreeing in every respect with the typical *T. Menardi,* Lamarck, from Le Mans, in France.

14. Terebratella truncata, *Sow.* Dav., Cret. Mon., Pl. III, figs. 34—41.

This species, or variety of *T. Menardi,* occurs in the Lower Greensand of Faringdon, and was likewise found by Mr. Meÿer at Guildford (Bargate Stone beds). A single valve was obtained from the Perna-bed of Sevenoaks.

15. Terebratella trifida, *Meÿer.* Sup., Pl. VIII, figs. 15, 16, 17.

Terebratella? trifida, *Meÿer.* The Geologist, vol. vii, p. 166, 1864; and Geol. Mag., vol. i, pl. xii, figs. 17—23, 1864.

Spec. Char. Shell about as wide as long; hinge-line nearly straight or widely obtuse. Dorsal valve semicircular, moderately convex, divided into three, five, or seven parts or ribs; the middle one, which is the largest, occupies the central division and forms a wide elevated mesial fold; the lateral ribs are smaller. Ventral valve much deeper and more convex than the opposite one, similarly divided into two, four, or six ribs, with a deep angular median sinus. The beak projects very little, sloping backwards, and truncated by a rather large circular foramen, partly completed by a deltidium in two pieces; beak-ridges sharply defined, leaving a flattened space or area between them and the hinge-line. The surface of each valve is crossed by strongly marked, almost equidistant, lines or ridges of growth. In the interior of the dorsal valve a small longitudinal septum, originating from beneath the hinge-plate, extends to about one third of the length of the valve. Loop doubly attached, resembling that of *T. Menardi.*

Length 5, width 5 lines.

Obs. This species has been well described and illustrated by Mr. Meÿer, who observes that, while approaching most nearly to *T. Menardi,* it is, however, readily distinguished by its very large and simple mesial fold and sinus.

Position and Locality. *T. trifida* occurs in the Bargate Stone beds (Aptian) near Tewsley, south of Godalming, and at a quarter of a mile west of St. Katherine Hill, near Guildford. In both localities the shell appears to be rather uncommon.

16. Terebratella pectita, *Sow.* Dav., Cret. Mon., Pl. III, figs. 29—33.

It is abundant in the Upper Greensand of Warminster, and was found by Mr. Meÿer in Chloritic beds near Beer Head, also at Swanage Bay, Dorset.

17. Terebratella oblonga, *Sow.* Dav., Cret. Mon., Pl. II, figs. 29—31.

The loop is the same as in *Terebratella Fittoni.* This remarkable and widely spread species varies very much in shape and character, some examples having their valves almost uniformly convex, with ribs gradually decreasing in width from the centre to the lateral margin, while others present an almost defined mesial fold with some of its ribs narrower than those that cover the lateral portions of the shell. It seems to characterise the Aptian or Lower Greensand of several British as well as foreign localities. In addition to Hythe, it has been found by Mr. Meÿer at Godalming and Sevenoaks, and in the Sponge-gravel of Windmill Pit, Faringdon; also in the Red Gravel of Badbury Hill. I picked it up in rocks of a similar age at Drap, near Nice. *T. oblonga* and its var. *pectiniformis,* Roemer, abound in the "Hils" (Lower Greensand) of Schoppendedt and of Essen, and is very common in the Neocomian or Calcaire à Spatangues of Morencourt, in France, and in many other places.

18. Terebratella Fittoni, *Meÿer.* Sup., Pl. VIII, figs. 8 to 13.

Terebratella Fittoni, *Meÿer.* Geol. Mag., vol. i, pl. xii, figs. 1—10, 1864.
? Terebratula quadrata, *Sow.* Fitton, Geol. Trans., 2nd ser., vol. iv, p. 338, pl. xiv fig. 9, 1836.

Spec. Char. Shell ovate, or somewhat irregularly pentagonal, a little longer than wide, greatest breadth about the middle; dorsal valve convex, nearly as wide as long. Ventral valve deeper and more convex than the opposite one, sometimes flattened along the middle; beak short, incurved; foramen small, slightly separated from the hinge-line by a deltidium in two pieces; beak-ridges sharply defined, with a flattened space between them and the hinge-line. Surface of both valves ornamented by a variable number of small, rounded, dichotomous ribs, with interspaces of about equal breadth between them. In some aged examples three or four central ribs are slightly more elevated than those on the lateral portions of the valves, producing an undefined mesial fold. Surface of valves crossed at intervals by concentric lines of growth. Loop long, doubly attached.

Length 9, width 8, depth 6 lines.

Obs. This species has been minutely described and illustrated by Mr. Meÿer, and since there prevails some uncertainty as to whether it and *T. quadrata,* Sow., may not be the same species, it will, I think, be preferable to retain for the shell under description the name given to it by Mr. Meÿer. It varies a good deal in shape and in the number of its ribs; from twenty-four to forty may be counted round the margin in different examples. It is a much smaller shell than *T. oblonga;* but some elongated specimens,

such as figs. 10 and 11, bear a certain resemblance to young individuals of Sowerby's species. It shows also a great deal of variability in the degree of incurvature of its beak. The nearest allied species seems to be the *Terebratula Beaumonti*, D'Archiac; but this, Mr. Meÿer observes, has the beak much shorter and more abruptly truncated, while the smaller valve is more inflated near the hinge-line. Internal casts show that the medial septum in the dorsal valve extended to fully half the length of the valve.

Position and Locality. This shell was first found by Mr. Meÿer in the pebble-bed at Tewsley, and at other places around Godalming. It is also extremely abundant in the Upper Neocomian or Lower Greensand phosphatic beds at Upware, near Cambridge. M. de Loriol informs me that he and M. Pictet have found specimens entirely agreeing with those from Upware in the Upper Neocomian (Aptian) at St. Croix, in Switzerland.

19. Terebratella Davidsoni, *Walker*. Sup., Pl. VIII, figs. 1 to 7.

Waldheimia? (Terebratella?) Davidsoni, *Walker*. Geol. Mag., vol. iv, p. 454, pl. xix, fig. 4, Oct., 1867, and vol. v, p. 405, 1868.

Spec. Char. Shell somewhat pentagonal or ovate, longer than wide, broadest about the middle, tapering to the beak, truncated in front. Dorsal valve moderately convex, most so at the umbo, flattened along the middle, slightly depressed near the front. Ventral valve much deeper and more convex than the opposite one, subcarinate and moderately arched in profile, laterally flattened; beak rather long, slightly incurved and truncated by a foramen which is more or less widely separated from the hinge-line by a deltidium in two pieces; beak-ridges sharply defined. Surface of both valves ornamented by numerous fine, radiating, raised ribs, which increase rapidly in number, after leaving the beaks, by the interpolation of shorter ribs between the longer ones. The ribs are also crossed at close intervals by numerous equidistant, more or less overlapping scale-like ridges, as well as by concentric lines of growth. Loop elongated and doubly attached.

Length 16, width 11, depth 6 lines.

Obs. This fine species seems to be nearest allied to *T. oblonga.* Its loop much resembles that of *T. Fittoni* in its arrangements. About forty-six ribs may, on an average, be counted round the margin of each valve. It varies a good deal, some specimens being much shorter, broader, and more convex than others, the deltidium differing also a good deal in its dimensions. Internal casts show that the septum in the dorsal valve extends to nearly half the length of the valve. Mr. Walker at first described this species as a *Waldheimia,* but soon after discovered that it was a *Terebratella.* The loop is attached as in *Terebratella,* but with a slight difference, for the extremity of the reflected portion almost touches the septum.

Position and Locality. Specimens from two to sixteen lines in length are very abundant in the Neocomian or Lower Greensand (phosphate beds) of Upware, and some single valves were found by Mr. Meÿer in the Bargate Stone of Guildford.

20. Trigonosemus elegans, *Koenig.* Dav., Cret. Mon., Pl. IV, figs. 1—4.

Nothing to add.

21. Trigonosemus incertus, *Dav.* Dav., Cret. Mon., Pl. IV, fig. 5.

Specimens have been found by Mr. Meÿer in the Chalk with green grains (Chloritic Marl) at Cliff, west of Beer Head.

22. Terebrirostra lyra, *Sow.* Dav., Cret. Mon., Pl. III, figs. 17 to 28.

The perfect loop has not yet been discovered, but sufficient has been found to show that it extended to near the front, and that there existed a short septum in the dorsal valve.

Dr. S. P. Woodward ('Manual,' p. 217) adopted the generic and specific name "*Lyra* (*Meadi*), Cumberland, 'Min Con.,' 1816," thus placing the designation *Terebrirostra Lyra* among its synonyms; but as Cumberland's name was only a manuscript one, and Sowerby subsequently both described and illustrated the shell under the specific name of *lyra*, this last, I think, should be retained for the species, and has been so adopted by almost every Palæontologist.

23. Kingena lima, *Def.*, sp. Dav., Cret. Mon., Pl. IV, figs. 15 to 28, and Pl. V, figs. 1—4.

Dr. Schloenbach regards as synonyms of this species *T. pectoralis*, Roemer, Kreid., &c.; *T. disparialis*, Geinitz (not D'Orb.); *T. Wacoensis*, Roemer; *T. formosa*, Kner; *T. sexradiata*, E. Deslong., and *Magos pumilus*, Heirn. I am not, however, sufficiently acquainted with some of these to be able to confirm his statements; and I am of opinion that Dr. Schloenbach has figured more than one distinct species under Defrance's *K. lima*. *Kingena lima* seems to have enjoyed a very extended vertical and horizontal range; for, in addition to the localities already given, it has been found by Mr. Judd in Chloritic Chalk at Hanna's Farm, Belfast, Ireland. The Rev. S. Lucas

has obtained this shell from the Chalk-marl of Watlington, Oxon, nor is it very uncommon in the Red Chalk of Hunstanton. It occurs in the Upper Greensand and Gault, and Mr. Meÿer informs me he has met with specimens in the Lower Greensand of Guildford in Surrey. The Rev. T. Wiltshire has found it in the Red Chalk of Speeton. It is a common fossil on the Continent. I collected it from beds corresponding with those of the Upper Greensand, or "Étage Vraconien," at Ese, between Nice and Monaco, and in the Upper Neocomian, or "Urgo-Aptien," at Drap, near Nice. I have it (*T. pectoralis*) from the Hils Conglomerate of Essen an der Ruhr, also from the Tourtia of Gussignes and Tournay, Belgium (*Ter. Gussigniensis*, D'Arch.), from the Upper Chalk of Stenaken, Holland, and the Lower Chalk of Rouen and Havre.

I am uncertain whether we should not maintain the *Kingena Hebertina* of D'Orb. (Cret. Mon., Pl. IV, fig. 18), from the Upper Chalk, as a distinct species or variety; it tapers more towards the front than do the generality of specimens of *K. lima*. The question will demand further consideration.

24. Terebratulina striata, *Wahlenberg*. Dav., Cret. Mon., Pl. II, figs. 18—25 (not 26), 27, 28 ?.

Dr. Schloenbach, in his 'Beiträge zur Paläontologie der Jura- und Kreide-Formation,' 1866, proposes that the term *chrysalis* (Schlotheim) should be substituted for that of *striata*, as being the oldest designation given to the species, and he adds a lengthened list of synonyms. I am ready to admit that the figures in Faujas's work, to which Schlotheim has referred us, do represent a very young stage of the shell under description; but as the name *striata* is in general use it should, I think, be retained.

According to Mr. Meÿer there seem to be two species in the English Chalk, one elongated and large, the other small and indented; but he does not know how to separate them, and is quite content to leave them provisionally under one name as I have done. *T. striata* is very variable in shape, as is the case with *T. caput-serpentis*, and I have seen many specimens that, had they been found alive or recent, would have been attributed to Linné's species. In general the front line of *T. striata* is slightly indented in the middle, and this corresponds with a slight longitudinal depression in one or both valves. The same thing occurs in the larger number of specimens of *T. caput-serpentis*. In this last, as well as in *T. striata*, we find examples with a straight and even slightly rounded front; and in such cases the longitudinal depression above described is absent in the dorsal valve, and but slightly defined in the ventral one. There exists, therefore, very little difference between the recent and the fossil shell. *T. pentagonalis* (Phillips) was named, but not described, by Phillips in p. 178 of the 'Geology of Yorkshire,' from a single valve stated to have been obtained from the Chalk; and the

specimen may be seen in the York Museum. This name is allowed by Dr. Schloenbach to be a synonym of the species under description.

Terebratulina Defrancei may or may not be a full-grown condition of *T. striata*. Some Palæontologists take one view, some the other. It will, therefore, be as well to retain the name *Defrancei* as, at least, a varietal designation. A great many so-termed species have been made out of variations in age and shape of this far-spread species, as is likewise the case with *T. caput-serpentis;* and it seems difficult to determine whether in reality *T. striata* has been found lower down than the Chalk-marl. Mr. Meyer is of opinion that the *Terebratulina* we have figured from the Upper Greensand may very probably constitute a well-marked variety or species. We will, therefore, keep them separate, as well as the shell (fig. 26) from the Speeton Clay of Knapton in Yorkshire.

D'Orbigny's *Terebratulina Dutempleana* and Schloenbach's *T. Seebachii* look very like young shells of *T. striata.*

It may likewise be a question for further consideration whether the *Terebratulina* (figs. 27 and 28) from the Upper Greensand of Warminster should constitute a distinct variety.

25. Terebratulina striata, var. Defrancei. Sup., Pl. II, fig. 13.

I am acquainted with the anterior half of a single specimen, which, if complete, would have measured about one inch and seven lines in length by one inch two lines in breadth. This fragment was described and figured by Mr. R. Tate in the 'Quart. Journ. Geological Society,' vol. xxi, p. 42, pl. iv, fig. 4, 1864, from a specimen found in the flinty flag (Upper Chalk) of Kilcorig, Lisburn, Ireland. In well-preserved examples of *T. Defrancei* the dorsal valve is comparatively very much more convex and laterally compressed than is the case with *T. striata,* and there exists also a wide, well-defined longitudinal depression near the front. The striæ, which cover the surface of the valves, are so exceedingly numerous and fine that they can be hardly seen without the aid of a lens. The front is also straight and does not show any trace of that indentation so commonly present in specimens of true *T. striata.*

26. Terebratulina striata, var. elongata, *Dav.*

Terebratulina striata, *Meÿer.* Geol. Mag., vol. i, p. 253, pl. xii, figs. 26, 27, 1864.

This species or variety (?), according to Mr. Meÿer's figures, differs from the Chalk specimens in being more regularly elongated in all stages of its growth and in not being indented in front. This last feature loses, however, somewhat of its importance from

the fact that specimens of *T. striata* from the Upper Greensand of Warminster present both rounded and indented fronts. This does not, however, appear to be quite constant. The beak is also more inflated and the foramen larger.

This variety occurs in the Bargate Stone (Upper Neocomian) of Guildford and Godalming in Surrey.

27. Terebratulina Martiniana, *D'Orb.* Dav., Cret. Mon., Pl. II, fig. 26.

Terebratulina Davidsoni, *Boll.* Die Brach. Kreidform. in Mecklenburg Neubrandenb., p. 37, 1856.
— Striata, *Dav.* Cret. Mon., p. 37, pl. ii, fig. 26, 1852.

Dr. U. Schloenbach, in his 'Beiträge zur Paläont. Jura- und Kreide-Formation,' p. 10, 1866, considers my fig. 26 to be referable to *Terebratulina Martiniana*, D'Orb.; and after a comparison of several foreign typical examples with the one found by Mr. Bean in the Speeton Clay of Knapton, in Yorkshire, I am inclined to admit the correctness of the view he has expressed.

Dr. Schloenbach gives the following synonyma:

Terebratulina Martiniana, *D'Orb.* Terr. Crét., vol. iv, p. 59, pl. 502, figs. 8, 12, 1847.
— striata, *Dav.* Cret. Mon., p. 37, pl. ii, fig. 26, 1852.
— Martiniana, *Stromb.* Zeitschr. g. G., xiii, pp. 44, 19, 53, 56, 1861.
— — *Credner.* Zeitschr. g. G., xvii, p. 247, 1865.

It is a shorter shell than *T. striata*, and broader anteriorly. D'Orbigny's specimens are stated to have been obtained from the Gault of the Geule d'Enfer, near Martignes (Bouches du Rhône), and Ravoix, near Villars de Lans (Isère). According to Mr. Meÿer it occurs at the base of the Red Chalk at Speeton. I will, however, answer for the specimen only that was found at Knapton. A search for more examples would be very desirable.

28. Terebratulina gracilis, *Schloth.* Dav., Cret. Mon., Pl. II, figs. 13, 14, 15 (not 16 and 17).

Terebratulina gracilis, *Schloth.* Leonhard's Taschenb., vii, p. 112, pl. iii, fig. 3, 1813.

In the work already alluded to Dr. Schloenbach insists that *T. gracilis*, Schloth., and

T. rigida, Sow., are distinct species, and since Mr. Meÿer takes a similar view it will be preferable to maintain them separate.

T. gracilis is wider and more circular in shape than *T. rigida.* The dorsal valve is also much flatter and the ribs comparatively stronger. It is also a much larger shell, some specimens from the Upper Chalk of Vaels having measured nearly half an inch in length and breadth, while some Swedish examples have attained to nearly similar proportions.

29. Terebratulina rigida, *Sow.* Dav., Cret. Mon., Pl. II, figs. 16, 17.

Terebratula rigida, *Sow.* Min. Con., vi, p. 69, tab. 536, fig. 2, 1829.

From the many synonyms collected by Dr. Schloenbach it appears that this species has been often referred to *T. gracilis.* It is, however, always smaller, more convex, and comparatively longer than *T. gracilis.* It occurs in the Kentish Chalk, the Upper Greensand of Cambridge, Grey Arenaceous Chalk and Red Chalk of Speeton, the Blue Gault of Norfolk, &c.

30. Terebratula ovata, *Sow.* Dav., Cret. Mon., Pl. IV, figs. 6—13; and Sup., Pl. II, fig. 14, and Pl. VII, figs. 1, 1 *a*, *b*, *c* (?).

The loop is short and simple. Specimens have been found in the Upper Greensand of Warminster, Dunscombe, Pinney Cliff, and the Isle of Wight, &c. When young the shell is ovate, with its valves regularly convex; the depression near the front is observable in adult individuals only. A young specimen in the Cambridge Woodwardian Museum (Pl. VII, fig. 1) is stated to have been obtained from the Greensand of Blackdown, which beds are considered by Renevier, Etheridge, and others, to be an equivalent of the Lower Greensand or Gault, especially of the upper part of the last-named formation. Brachiopoda are extremely rare at Blackdown; I have never seen or heard of more than this specimen and two or three of a *Rhynchonella.*

31. Terebratula arcuata, *A. Roemer.* Dav., Cret. Mon., Pl. IV, fig. 14; Sup., Pl. II, fig. 16.

Terebratula rugulosa *Morris.* Dav., Cret. Mon., p. 49, pl. iv, fig. 14, 1847.
— arcuata, *A. Roemer.* Kreid., p. 44, pl. vii, fig. 18, 1841.
— — *Schloenbach.* Ueber die Brach. der Nord. Cenoman-Bildungen, p. 451, pl. xxi, fig. 12, 1841.

Dr. Schloenbach has justly reminded us that this species was correctly described and figured by Roemer in 1841 under the designation of *Tereb. arcuata;* his name must, therefore, be adopted.

32. Terebratula squamosa, *Mantell.* Dav., Cret. Mon., Pl. V, figs. 5—11; Sup., Pl. II, fig. 15.

The loop is short and simple. Specimens have been found by Mr. Meÿer in the Chalk-marl of Folkestone and the Chloritic Marl of Pinney Cliff, near Lyme Regis.

33. Terebratula capillata, *D'Arch.* Dav., Cret. Mon., Pl. V, fig. 12; Sup., Pl. VII, figs. 2, 2*a*—*c*.

Three specimens of this species have been found by Mr. Keeping in the Lower Greensand at Upware, and are deposited in the fine collection of fossils, from that locality, in the Woodwardian Museum, Cambridge. These specimens agree more closely with those from the Tourtia of Belgium than do those that occur in the Red Chalk of Hunstanton. The last are more ovate and convex than the Belgian specimens, and also much larger. It may possibly be necessary to consider the "Red Chalk" shell as a distinct species or variety. The external sculpture in the specimens from the Red Chalk, the Lower Greensand, and the Tourtia is, however, exactly the same, and as many as twenty of the characteristic small ribs may be counted in the width of two lines. We are not acquainted with the apophysary arrangements in this species.

34. Terebratula biplicata, *Sowerby.* Dav., Cret. Mon., Pl. VI, figs. 1—42 only; Sup., Pl. V, figs. 1, 2.

Much confusion seems to prevail with reference to the biplicated species of *Terebratulæ* that occur in the Tertiary, Cretaceous, and Jurassic formations, and, indeed, one scarcely knows how to deal with species so variable, and at the same time bearing, in many cases, so much general outward resemblance as to render their separation into distinct, well-characterised species a matter of no small difficulty and uncertainty. Palæontologists are now very generally of opinion that the term *biplicata* should be retained exclusively for the shell described and figured by Sowerby (tab. 437, figs. 2, 3, and 4), and that Brocchi's designation may be entirely dispensed with.[1]

[1] In 1860 Messrs. Saeman and Triger visited the Museum of Milan, where Brocchi's collection is preserved, and carefully examined the specimen to which the Italian palæontologist had, in 1814, given

Dr. Schloenbach considers *T. faba*, Sow., *T. Dutempleana*, D'Orb., and *T. sulcifera*, Morris, to be synonyms of *T. biplicata,* or varieties. We must, however, differ from him with respect to *T. sulcifera*. Mr. Meÿer is of opinion that the specimens I have figured as *T. biplicata* (Pl. VI, figs. 45 to 49, and Pl. IX, figs. 36, 37) should be considered to be varieties of *T. sella*.

Terebratula biplicata exceeds two inches in length in the Red Chalk of Hunstanton, as well as in the Gault of Folkstone. In the Upper Greensand at Warminster it becomes still larger. In the Red Chalk of Speeton it is rare (Rev. T. Wiltshire). I am not certain whether it occurs above the Grey Chalk and lower down than the Gault. It is a very common species in the Upper Greensand of Ese, near Monaco, the specimens found there being exactly similar to those that occur at Cambridge. I have specimens also from the Gault of the Perte du Rhône; Goudinière; Grand Bernard; Glacier du Breton (Savoie); Grand Pré, Escragnolles (France); and many other places. Specimens from the Upper Greensand of Vivortier (Oise) and the Chloritic Chalk of Rouen exactly agree with those that are found at Warminster.

TEREBRATULA SELLA, *Sow.*

This is a very variable and perplexing species. Mr. Meÿer, who has devoted much attention to its study, informs me by letter that "there appears to be a considerable difference in the form of *T. sella* of the lowest and the highest beds of the Lower Greensand: those obtained from the 'Perna-bed' at Atherfield, Peasemarsh, &c., have their edges acute and the front much elevated; this form being well represented in Pl. VII, fig. 4, of your Monograph. The *T. sella* of the upper beds at Shanklin have their edges much less acute, the front less elevated, the beak more elongated, and the valves more equally convex (Pl. XIV, figs. 9—12). They vary very much among themselves. The resemblance of some of these varieties to several forms of D'Archiac's Tourtia species struck me on a former occasion as being not a little singular, and, as far as a comparison with figures can be trusted, I should say that D'Archiac's figures of *T. Roemeri*, *Bouei*,

the name *Anomia biplicata;* and they published in the 'Bulletin of the Geol. Society of France,' 2nd ser., vol. xix, p. 160, 1861, the results of their examination. They subsequently went to San Quirico, in Tuscany, and, after a minute inspection of the strata, arrived at the conclusion that the *Terebratula* in question could not have been obtained from the locality named by Brocchi. On their return to Paris they submitted the specimen itself to M. E. Deslongchamps, who assured them that Brocchi's fossil belonged to the Jurassic period, and that after a minute comparison he had arrived at the opinion that the *Anomia biplicata* of Brocchi and the *Terebratula indentata*, Sow. (from the Lias) belonged in all probability to the same species, but that on account of the beak being incomplete, and from the absence of all positive knowledge respecting its stratigraphical position and locality, as well as generic allocation, it would be desirable that Sowerby's name, *biplicata*, should be retained for the Upper-Greensand shell, and that of *indentata*, Sow., for the Liassic species.—(Deslongchamps, 'Pal. Franç., Brachiopodes Jurassiques,' p. 133.)

crassa, and *rustica* can be fairly matched among the specimens of *T. sella* from Shanklin. A comparison of the same Shanklin species with my specimens from Faringdon has also led me to conclude that many of the forms attributed to *T. Roemeri*, and all of the supposed *T. biplicata* of the Sponge-gravels, are referable to the Shanklin variety of *T. sella*. It is true that in the generality of the Faringdon specimens the foramen is larger than in any of those met with at Shanklin, but then it appears to me that the large size of the foramen is a feature peculiar to all the Faringdon Brachiopoda, not excepting *Waldheimia tamarindus*. With regard to *Terebratula biplicata*, all the specimens which I have seen from the Upper Greensand have the beak so closely incurved as almost completely to hide the deltidium, as represented in your Monograph, Pl. VI, figs. 1 to 42. I should, therefore, question the identification of the figures 45 to 49, Pl. VI, as well as figures 36—37, Pl. IX of your Monograph, all of which might probably be referable to the Shanklin variety of *T. sella*."

Mr. Meÿer is so accurate an observer that I feel anxious his observations in connection with this difficult question should be duly considered.

It will, I think, be preferable for the present, at least, to group the different forms of *T. sella* into three or four varieties, namely—

35. Terebratula sella, *Sow.* Dav., Cret. Mon., Pl. VII, figs. 4—10.

There can be no doubt that the figures above quoted represent the typical forms of Sowerby's species, as occurring in the Lower Greensand of the Isle of Wight. The loop is short, simple, and wide as compared with that of *T. biplicata*. *T. sella* ranges from the "Perna-bed" to the top or nearly the top of the Lower Greensand, but does not appear to enter the Gault or pass above it.

36. Terebratula sella, var. Upwarensis, *Walker.* Sup., Pl. V, figs. 3 to 10 *a*.

Terebratula sella, var. Upwarensis, *Walker*. Geol. Mag., vol. vii, 1870, p. 562.

Mr. Walker describes this variety as "globular, deeply plicated, sides of the shell compressed, surface smooth, marked by faint concentric lines of growth; ventral valve very much incurved, the deep plications extending about two thirds of the length of the valve, forming a central elevation on each side of it, and a deep depression, again rising into an elevation; thence, bending at right angles, it forms the flat side of the shell; the upper third of the shell is somewhat convex; the beak curved, short, truncated by a large round foramen, the margin of which is thickened at the sides; the beak-ridges rounded; deltidium in one piece, shallow and wide; dorsal valve

irregularly round in shape, upper two thirds nearly flat, lower (front part) deeply plicated, having a deep groove in the centre, bounded on each side by an elevation, then a wide depression which slopes to meet the lateral elevations of the ventral valve, thence rising to the level of the flat part of the valve, where the shell has its greatest width. Loop short. Average dimensions :—length, 1·1 in.; breadth, 0·9 in.; thickness, 0·8 in."

This variety approaches very closely to *T. Carteroniana,* D'Orb., and indeed some specimens seem to be undistinguishable. It varies also very much, some specimens being much flattened, while others are almost globular. The biplication is likewise much more deeply indented in some examples than in others. This shell is exceedingly abundant in the Lower Greensand or Upper Neocomian at Upware, Cambridgeshire, and where very finely preserved internal casts are likewise obtainable.

37. Terebratula sella, var. Dav., Cret. Mon., Pl. VI, figs. 45, 49; Pl. VII, figs. 11—16; Pl. IX, figs. 36, 37; and Sup., Pl. V, figs. 11—16.

Terebratula tornacensis, *D'Archiac* (in part).

According to Meÿer these shells (Sup., Pl. V, figs. 11 to 14) would constitute an extreme variety of *T. sella* as found in the upper beds of the Lower Greensand of Shanklin, and Tealby, in Lincolnshire. It would likewise include a dwarf race of *T. sella* occurring in the Sponge-gravel of Faringdon, and which we had formerly referred to the *T. tornacensis* and var. *Roemeri* of D'Archiac (Sup., Pl. V, fig. 15). It may also be observed that some of the specimens attributed to *T. sella*, var. *tornacensis,* bear much resemblance to certain forms of *T. acuta*, Quenstedt, of which M. de Loriol has figured a fine series of specimens in pl. xv of his excellent memoir on the fossils occurring in the Middle Neocomian of the Mountain of Salève, near Geneva.

38. Terebratula phaseolina, *Lamarck?* Sup., Pl. V, figs. 17, 17 *a, b*.

Terebratula phaseolina, *Lamarck?* An. sans Vert., vol. vii, p. 251, No. 29, 1819.

Mr. Meÿer has found a small biplicated *Terebratula* in the Upper Greensand of Niton, Isle of Wight, which he believes may be referable to the Lamarckian species. It is ovate and biplicated near the front, nine lines in length by seven in width and five in depth. It appears to agree with some specimens of that species from the zone of *Inoceramus labiatus* of Lemaine, in France.

I have seen one specimen only (from the collection of Mr. Meÿer); more examples and

further comparison will, therefore, be needed before *T. phaseolina* can be definitely admitted as a British species.

39. Terebratula obesa, *Sow.* Dav., Cret. Mon., Pl. V, figs. 13—15, 16 ?

Mr. Ralph Tate has found a fine example of this species in the Upper Chalk near Lisburn, County Antrim, Ireland. Others have been collected by Mr. Meÿer from the Chloritic Marl of Pinney Cliff and the Grey Chalk near Caterham. The finest and most typical specimens of the species were, however, obtained from the Upper Chalk of Norwich; and from that locality some very fine examples may be seen in the British Museum.

40. Terebratula sulcifera, *Morris.* Dav., Cret. Mon., Pl. VII, figs. 17—20.

I have nothing further to add.

41. Terebratula prælonga, *Sow.* Dav., Cret. Mon., Pl. VII, figs. 1, 2; Sup., Pl. III, figs. 12, 12 *a*—*c*, 13.

Until the year 1867 *Terebratula prælonga* was one of our rarest British fossils. It has, however, since then been found to occur abundantly in the Lower Greensand at Upware, in Cambridgeshire; from which locality large and fine examples have been collected, and of these I have given some illustrations. Mr. Meÿer has obtained specimens of this species at Shanklin (at the base of the Folkstone beds), and one example in the "Sponge-gravel" of Farringdon. The loop is short and simple. Some specimens are more than two inches in length, by one inch two lines in breadth. This species has been badly understood by French and German Palæontologists; the specimens they refer to it belong to other species.

42. Terebratula microtrema, *Walker.* Sup., Pl. V, figs. 18, 18 *a*—*c*, 21.

Terebratula microtrema, *Walker.* Geol. Mag., vol. v, p. 401, pl. xix, figs. 7, 8, 1868.

Spec. Char. Shell somewhat squarely oblong-oval or ovate; greatest breadth towards the frontal margin, sides compressed or sub-parallel. Valves regularly convex to about

half their length from the beaks. Dorsal valve biplicated near the front, with a deep rounded sinus between the plications. Ventral valve with a projecting central rounded rib, commencing to rise at about half the length of the valve from the beak and extending to the front, with a depression on either side. Beak very short, incurved, and truncated by a large circular foramen, slightly separated from the hinge-line by a narrow deltidium in one piece; beak-ridges obsolete. Surface smooth, marked at intervals by concentric lines of growth; frontal margin more or less deeply biplicated. Loop short, a little wider than in *T. expansa*. Shell-structure with few and small perforations. Average length 16, width 10, depth 9 lines.

Obs. Mr. Walker has devoted much care in his study of this species, which he considers to be at once distinguishable from *T. prælonga* by its peculiar shell-structure, and in that it is more compressed at the sides, the foramen more approximated to the hinge-line, and the beak shorter. He adds likewise that it is well distinguished from *T. biplicata* by its shell-structure and general shape. The forms in which the plications are less conspicuous approach most nearly in appearance to *T. extensa*; but it differs from that species in the shell-structure, in being wider, and in the ventral valve being flattened towards the front margin. We are also informed that he had originally placed some of the specimens of this species among the varieties of *T. prælonga* and others among those of *T. extensa;* but that Mr. A. Wanklyn having made him some microscopic preparations of the shells of the *Terebratulæ* occurring at Upware, they had both found that those doubtful specimens presented the peculiar accordant structure, quite distinct from both *T. extensa* and *T. prælonga.*

Position and Locality. *T. microtrema* is abundant in the Lower Greensand at Upware. Mr. Meÿer has a specimen from Shanklin, Isle of Wight, a single valve from Faringdon, and a doubtful specimen from Godalming.

43. Terebratula Lankesteri, *Walker.* Sup., Pl. III, figs. 9—11.

Terebratula Lankesteri, *Walker.* Geol. Mag., vol. v, p. 402, pl. xix, figs. 2, 3, 1868.

Spec. Char. Shell ovate, longer than wide, broadest about the middle, greatest depth near the front or anterior half of the valves; tapering to the beak, rounded or slightly indented in front. Dorsal valve evenly convex and abruptly bent (at almost right angles) near the front and lateral margin. Ventral valve very convex and gibbous, much bent before reaching the front and lateral margin; beak moderately incurved and truncated by an oval foramen, separated from the hinge-line by a smallish deltidium in one piece; beak-ridges obsolete. Surface of both valves closely marked by numerous fine, radiating, flexuous striæ, which become more apparent, and assume a peculiar zigzag appearance as they near the margin, occasioned mainly by these last

being intersected by concentric lines of growth, and which become more numerous and more deeply indented as they approach the margin. Shell-perforations smaller and wider apart than in *T. prælonga.* Loop short. A large specimen measured 1 inch 11 lines in length, by 1 inch 3 lines in width, and 1 inch 6 lines in depth.

Obs. Mr. Walker states that this species "may be distinguished from *T. prælonga* by its surface being covered with fine striæ, by its more oval shape, the absence of plications at the front margin, the tendency of the front margin to become inflated, by its shell-structure, by the beak being more incurved, and by the deltidium being shallower. From *T. Dallasii* it differs by being longer and more oval, and by its striated surface. From *T. capillata* by being more elongated, by its ventral valve being more tapering towards the beak, by the dorsal valve being less convex, and by its beak being longer."

A fine series of specimens may be seen in the Woodwardian Museum at Cambridge, and we have figured two of the most remarkable examples that have fallen under our notice. In some specimens the thickening of the margin and front is enormous.

Position and Locality. It has been found only, as far as I am aware, in the Lower Greensand at Upware, in Cambridgeshire. Not very abundant.

44. Terebratula abrupta, *Tate.* Sup., Pl. II, figs. 17, 17 *a*, *b*.

Terebratula abrupta, *Tate.* Quarterly Journal Geol. Soc., vol. xxi, p. 41, pl. v, fig. 1, 1864.

Spec. Char. Shell elongated, oval, about one third longer than wide, greatest breadth about the middle, whence it tapers to the beak and front. Dorsal valve most convex at the umbo, plicated near the front. Ventral valve slightly deeper or more convex than the opposite one, with a small rounded rib close to the front; beak slightly incurved, very short, and truncated by a large foramen. Deltidium and beak-ridges almost inconspicuous; surface smooth, marked by concentric lines of growth.

Length, 2 inches 1 line; width, 1 inch 4 lines; depth, 1 inch.

Obs. This fine *Terebratula* has been well described and figured by Mr. Ralph Tate. It appears to be tolerably distinguishable from *T. obesa*, *T. biplicata*, and *T. prælonga*, by its very short and transversely truncated beak. In some examples the extremity of the beak is much worn, from the shortness of the pedicle. I have not seen the loop; but it was, in all probability, short and simple, and not unlike that of *T. biplicata.*

Position and Locality. Mr. Tate found this species in the White Limestone or Upper Chalk of Lisburn, near Antrim, and at Moira, in Ireland, and where it is rare. Specimens in the Portlock Collection in the Museum of Practical Geology are from Dungiven, County Kerry, Ireland. Mr. S. A. Stewart obtained it likewise at Colin Glen, near Belfast.

45. Terebratula depressa, *Lamarck*. Dav., Cret. Mon., Pl. IX, figs. 9—24; Sup., Pl. IV, figs. 1 and 3, 4.

Terebratula depressa, *E. R. Lankester*. The Geologist, vol. vi, p. 414, pl. xxi, figs. 4—6, 1863.
— — *C. J. A. Meÿer*. Geol. Mag., vol. i, pl. xi, fig. 15, 1864.
— — *J. F. Walker*. Ib., vol. v, p. 403, pl. xviii, figs. 2, 2 *a*, 1868.
— — *J. W. Judd*. Quarterly Journal Geol. Soc., vol. xxiii, p. 245, 1868.

At page 29 of my Monograph I described the typical form of *T. depressa* (Lamarck) as found in the "Sponge-gravel" of Faringdon, and agreeing in every respect with specimens that occur in the Tourtia of Tournay, Montignies-sur-Roc, and Gussignies, in Belgium. Since that period much larger and better examples of the typical form have been found in the Lower Greensand at Upware. The shell varies greatly in shape, the beak being in some specimens very much elongated and tapering, whilst in other examples it is short and rounded. A great difference is also observable in the degree of convexity of the dorsal valve. In some specimens there exists a mesial fold without any depression along its middle, while in other examples a shallow longitudinal depression is observable along the middle of the fold, giving the valve a slightly biplicated appearance.

Mr. Walker has therefore proposed to apply varietal designations to two or three of these modifications of *T. depressa*, which he regards as sub-species.

Typical forms of *T. depressa* have been described by Mr. E. R. Lankester and C. J. Meÿer from the Lower Greensand (Folkstone beds or Upper Neocomian) of Shanklin, Isle of Wight, and of Guildford, Surrey. Mr. J. W. Judd and Mr. Walker have found the same shell in the Middle Neocomian at Tealby, in Lincolnshire. I was therefore mistaken when, at p. 71 of my Monograph, I placed this species in the Upper Greensand. Messrs. Pictet and De Loriol have met with well-characterised and large specimens in the "Étage Aptien" at St. Croix, Switzerland. I have also a specimen from the Lower Greensand of Essen-an-der-Ruhr.

I will now reproduce Mr. Walker's descriptions of his several varieties of *T. depressa*.

46. Var. uniplicata, *Walker*. Sup., Pl. IV, figs. 2, 5, 5 *a*.

Walker, Geol. Mag., vol. vii, 1870, p. 561, figs. 1, 2.

"Shell somewhat triangular in form, with one wide mesial fold; surface smooth, marked by faint concentric lines of growth; greatest width about the middle of the

shell; thence it tapers to the beak, which is nearly straight, and is truncated by a large circular foramen; beak-ridges rounded; deltidium wide, in one piece. At the front margin there is a wide central fold, formed by a depression of the ventral and a corresponding elevation of the dorsal valve. Loop short." Dimensions:—Length 3 inches 4 lines, width 2 inches 11 lines, depth 1 inch 7 lines.

This variety occurs at Upware. A fine series of specimens may be seen in the Woodwardian Museum, Cambridge.

47. Var. CYRTA, *Walker*. Sup., Pl. IV, figs. 6, 7.

Walker, Geol. Mag., vol. v, p. 404, pl. xviii, fig. 1, 1868.

"Shell convex, inflated, width and length nearly equal, becoming flatter towards the frontal margin; beak short, rounded, truncated by a large foramen. Beak-ridges ill-defined; deltidium in one piece, wide, but shallow. Ventral valve globose; dorsal valve very globose towards the beak. Frontal margin not plicated; the valves slightly flexuous. Shell-surface smooth, marked with concentric lines of growth, and sometimes with obscure radiating lines. Loop short." Dimensions:—Length 1 inch 11 lines, width 1 inch, 9 lines, depth 1 inch.

"This variety occurs at Upware and at Potton along with the typical form, from which it differs by its greater convexity, by its beak being shorter and more rounded, and by its deltidium being much shallower."

48. Var. CANTABRIDGIENSIS, *Walker*. Sup., Pl. IV, figs. 8—10 *b*.

Walker, Geol. Mag., vol. vii, 1870, p. 561, figs. 3, 4, 5.

"Shell moderately convex, surface smooth, marked by concentric lines of growth; beak slightly recurved, deltidium wide, in one piece; front margin of the ventral valve slightly elevated at the centre, then depressed, and again elevated; dorsal valve has two ridges, which rise from near the centre of the valve, and terminate at the front margin, having between them a wide central depression. Loop short."

Length 1 inch 7 lines, width 1 inch 5 lines, depth 11 lines.

"This form varies considerably with regard to the thickening of the front margin; some specimens have the front margin thinner and more rounded than the specimen figured, but retain the same form of plication, being reverse to the var. *T. uniplicata*, which has the central elevation on the dorsal valve and the depression on the ventral valve. *T. Cantabridgiensis* differs from *T. Dutempleana* in having the beak less recurved and the front margin more rounded. This variety approaches *T. prælonga* in the plications, but differs from that species in its greater width, form of its beak, &c."

I am very much inclined to believe that *T. Cantabridgiensis* should be considered specifically distinct from *T. depressa* and its varieties. It occurs in the Lower Greensand at Upware, but not so abundantly as *T. depressa*. It is also possible that *T. cyrta* may require to be detached from the last-named species.

49. Terebratula Robertoni, *D'Archiac.* Dav., Cret. Mon., Pl. IX, fig. 25; and Sup., Pl. V, fig. 26.

A shell much resembling D'Archiac's species occurs at Faringdon, and likewise, according to Mr. Meÿer, at Godalming; but there prevails still much uncertainty relative to the value of the species, and until more abundant material is procured this identification will require to be considered provisional.

50. Terebratula Moutoniana, var., *D'Orb.?* Sup., Pl. IV, figs. 11—13.

Terebratula Moutoniana, *D'Orb.* Terr. Crét., pl. 510, figs. 1—5, 1847.
— — *W. A. Ooster.* Pét. remarquables des Alpes Suisses, p. 20, pl. iv, figs. 19—21; pl. v, figs. 5—12; and pl. viii, figs. 6—8, 1863.
— — *Schloenbach.* Zeitschr. Deutschen geolog. Gesellschaft, 1866.
— — *Walker.* Geol. Mag., vol. v, p. 403, pl. xviii, fig. 6, 1868 (non *Waldheimia Moutoniana*, D'Orb., Lankester, Geologist, vol. vi, p. 414, pl. xxi, figs. 1—3, 1863).
— — *Pictet.* Mélanges Paléontologiques, 2nd liv., p. 103, pl. xxv, figs. 1—4, 1867.

Spec. Char. Oval, elongated, widest about the middle, slightly truncated in front. Ventral valve uniformly convex, without sinus, much arched in profile; beak not much produced, slightly incurved and truncated by a largish foramen, separated from the hinge-line by a wide and narrow deltidium in one piece; beak-ridges inconspicuous. Dorsal valve convex, with a rounded mesial fold and lateral depressions. Surface smooth, marked only by concentric lines of growth. Loop short and simple, not as wide as that of *T. sella.*

Length 1 inch 5 lines, width 11, depth 10 lines.

Obs. Although there exists in this species an appreciable mesial fold in the dorsal valve of many specimens, no corresponding sinus or depression is present in the ventral one. It varies, however, a good deal, while some French and Swiss examples attain larger dimensions than they do in Great Britain, and are comparatively broader.

Externally it bears some resemblance to *Waldheimia Morrisii*, Meÿer; but this last-named species has a long loop, while that of *T. Moutoniana* is short, a circumstance with which Mr. Lankester was not acquainted when he identified his *Terebratula* from Shanklin with d'Orbigny's species.

Position and Locality. Very abundant in the Lower Greensand at Upware, in Cambridgeshire. Mr. C. J. A. Meÿer has two large valves from the "Sponge-gravel" at Faringdon, and also a specimen from Hythe. In France it is a common fossil in the Upper Neocomian at Caussols, at Saint Aubon and Saint Martin, near Escragnolles (Var), at Sisteron (Basse-Alpes), at Berrias, Ardiche; also in the Aptian at Gévaudan (Basse-Alpes), at Gargas (Vaucluse). Mr. W. A. Ooster describes and figures *T. Moutoniana* from various localities in the Alpes d'Uri, of Appenzell, Schwytz, Unterwalden, Lucerne, and the Vallais.

51. Terebratula extensa, *Meÿer*. Sup., Pl. V, figs. 22—24.

Terebratula extensa, *Meÿer*. Geol. Mag., vol. i, pl. xii, figs. 1—4, 1864.
— — *Walker*. Ib., vol. v, pl. xviii, fig. 5, 1868.

Spec. Char. Oblong oval, broadest about the middle, tapering to the beak, slightly curved or nearly straight in front. Dorsal valve moderately convex, most so at the umbone, slightly elevated from the middle to the front in the shape of a flattened mesial fold, much depressed at the sides. Ventral valve deeper and more evenly convex than the opposite one, slightly flattened along the middle and towards the front. Beak short, very moderately incurved and truncated by a circular foramen, separated from the hinge-line by a narrow deltidium in one piece; beak-ridges feebly defined. Surface smooth, marked by concentric lines of growth. Loop short and simple, comparatively narrow.

Length 14, width 7, depth 6 lines.

This species was well described and figured by Mr. Meÿer in 1864, and is easily distinguished from *Ter. prælonga* and *T. microtrema* by the absence of biplication; but, although generically and specifically distinct, it bears a slight external resemblance to some specimens of *Waldheimia Celtica*.

Position and Locality. It occurs at the base of the "Folkstone beds" at Godalming and in the Upper Neocomian or Lower Greensand at Upware.

52. Terebratula Seeleyii, *Walker*. Sup., Pl. VII, figs. 3, 3 *a*, 4.

Terebratula Seeleyii, *Walker*. Geol. Mag., vol. vii, p. 561, Dec., 1870.

Spec. Char. Shell elongated oval, tapering from the middle to the beak and front,

greatest breadth towards the middle. Valves moderately convex, with or without a slight median depression in the dorsal valve, which, when present, extends from about the middle of the shell to the front. Ventral valve evenly convex, beak incurved and truncated by a largish foramen, separated from the hinge-line by a deltidium in one piece; beak-ridges slightly rounded; front margin straight or slightly biplicated. Surface smooth, marked by concentric lines of growth. Loop short. A large specimen measured—

Length 1 inch 9 lines, width 1 inch, depth 8 lines.

Obs. This species bears some resemblance to *Wald. Wanklyni;* but, besides being referable to another genus, it may be distinguished by the shape of its beak and deltidium, which in the shell under description is in one piece, while in *W. Wanklyni* it is made up of two pieces. Although young and half-grown specimens show a complete absence of biplication, a slight longitudinal depression is present in the dorsal valve of some aged individuals. A fine series of specimens from the Lower Greensand of Upware may be seen in the Woodwardian Museum, Cambridge.

53. Terebratula Meyeri, *Walker*. Sup., Pl. III, figs. 6—8.

Terebratula Meyeri, *Walker*. Geol. Mag., vol. v, p. 401, pl. xix, fig. 6, 1868.

Spec. Char. Shell longitudinally oval, greatest breadth and thickness about the middle. Ventral valve convex, most so along the middle, where it forms a rounded longitudinal fold or keel with lateral depressions. Beak very short, slightly incurved, and usually worn from friction, caused by the shortness of its pedicle; foramen large, and separated from the hinge-line by a wide but narrow deltidium in one piece. Dorsal valve convex, most so about the middle; with a slight longitudinal depression commencing at the umbo and widening as it nears the front; lateral margin sinuous, and very much curved backwards near the front. Surface smooth, marked by numerous, more or less strongly indented, lines of growth. Loop simple, and very wide as compared to its length.

Length 18, width 13, depth 10 lines.

Obs. This species is easily distinguishable by its shape from other Cretaceous forms of the genus *Terebratula,* and especially so on account of the mesial fold in the ventral instead of the dorsal valve.

Position and Locality. T. Meyeri occurs in the Lower Greensand at Upware, in Cambridgeshire. Mr. C. J. A. Meÿer has found a specimen, which he believes may be referable to the same species, in rocks of a similar age at Guildford.

54. Terebratula Dallasii, *Walker*. Sup., Pl. III, figs. 1—5.

Terebratula Dallasii, *Walker*. Geol. Mag., vol. iv, p. 455, pl. xix, fig. 1, 1867; and vol. v, p. 404, 1868.

Spec. Char. Shell ovate-globose, sometimes slightly pentagonal, longer than wide, greatest breadth at about half its length; both valves very deep, moderately convex to about two thirds of their length, when they become suddenly bent downwards at right or obtuse angles until they meet at the margin. Beak short, more or less incurved, and truncated by a large foramen; deltidium wide and narrow, in one piece. Surface smooth, marked by concentric lines of growth. Loop simple and short. Two specimens measured—

Length 12, width 10, depth 12 lines.
„ 15, „ 10, „ 9

Obs. This remarkable species was well described by Mr. Walker. Some examples have attained to one inch and a half in length. It so closely simulates some thickened specimens of *Wald. tamarindus* as to be almost mistakable for it, but may be at once distinguished by the shortness of its loop. Internal casts show no evidence of the existence of a septum in the smaller valve. The adductor muscular scars are large in proportion to the shell.

Position and Locality. T. Dallasii occurs, but not very abundantly, in the Lower Greensand of Upware, and likewise in the Conglomerate bed near Potton, the latter specimens being ferruginous. Mr. Meÿer has some examples from the "Sponge-gravel" of Faringdon, which he thinks may be referable to the species under description.

55. Terebratula semiglobosa, *Sow.* Dav., Cret. Mon., Pl. VIII, figs. 6—18.

Terebratula semiglobosa, *Tate.* Quarterly Journal Geol. Soc., vol. xxi, p. 30, 1864.

Some large globose specimens similar to those that occur in the Chloritic Chalk of Mont St. Catherine, Rouen, have been found in the Lower Chalk of the Isle of Wight. It has also been met with in great abundance in the Lower Grey Chalk or Limestone near Belfast, and is not uncommon in the Red Chalk at Speeton and the Chloritic Marl of Pinney Cliff and Beer.

56. Var. Hibernica. Sup., Pl. II, figs. 18—20.

A large flattened variety (if not distinct species), intermediate in shape between

T. semiglobosa and *T. carnea,* with and without biplication near the front, has been found by Mr. Tate in the Hibernian Greensand near Belfast, Ireland.

I have felt and still feel very uncertain with reference to this shell; for, while some examples resemble flattened specimens or *T. semiglobosa,* others cannot be distinguished from *T. carnea,* and every variation connecting the two extremes can be obtained.

T. carnea is a very characteristic fossil of the White Chalk with *Belemnitella mucronata,* while *T. semiglobosa* occurs in the Lower Chalk and Red Chalk of Speeton, in Yorkshire, and in the upper part of the Red Chalk of Hunstanton. Now, according to Mr. Tate[1]—

"1. The Cretaceous rocks of Ireland are referable to two formations, the Hibernian Greensand and the Upper Chalk.

"2. The Hibernian Greensand is divisible into well marked lithological and palæontological zones, and is the equivalent in miniature of the 'Étage Cénomanien' of D'Orbigny.

"3. The zone of *Exogyra conica* represents the basement-beds of the 'Étage Cénomanien' of the French geologists, and is approximately equivalent to the Greensand of Blackdown.

"4. The zone of *Ostrea carinata* represents most certainly a portion of the Upper Greensand of England and the Lower Cenomanian of Normandy.

"5. The Chloritic Sands and Sandstones have, on the whole, a fauna possessing an Upper-Greensand facies, many species, however, pointing to higher zones.

"It is very probable that the Chloritic Sands of Woodburn (the 'Zone of *Inoceramus Crispi ?*') may be inferior to the Chloritic Sandstones of Colin Glen, the 'Zone of *Exogyra columba.*' These two zones, however, never come in contact.

"6. The Upper Chalk contains three subdivisions:

"*a.* Zone of *Ananchytes gibbus.*

"*b.* Spongarian Zone.

"*c.* White Limestone, or 'Zone of *Ammonites Gollevillensis.*' The White Limestone certainly represents the Upper Chalk of Norwich and the 'Craie de Meudon;' and some of its fossils point even to a higher parallel—that of the Maestricht Chalk."

Now, we find in Ireland *T. carnea* in its true stratigraphical position, namely, in the hardened White Chalk of Antrim. Lower down, in the Hibernian Greensand near Belfast, we find true *T. semiglobosa* and the intermediate form, or what we will provisionally designate as the var. HIBERNICA.

[1] See R. Tate, "On the Correlation of the Cretaceous Formations of the North-East of Ireland," 'Quarterly Journal of the Geol. Soc.,' vol. xxi, pp. 33, 36, 1864.

57. TEREBRATULA CARNEA, *Sow.* Dav., Cret. Mon., Pl. VIII, figs. 1—5.

Some internal casts in flint nodules of this species have been picked up at Cruden, in Aberdeenshire (see Davidson, "Scottish Cret. Brach.," 'The Geologist,' December, 1862, vol. v, p. 446, pl. xxiv, fig. 14).

SPECIES WITH LONG LOOPS.

58. WALDHEIMIA CELTICA, *Morris.* Cret. Mon., Pl. IX, figs. 32—34; and Sup., Pl. VI, figs. 15, 15 *a.*

We figure a large specimen from the "Folkstone beds" near Shanklin.

59. WALDHEIMIA MORRISII, *Meÿer.* Sup., Pl. VII, figs. 19, 20.

TEREBRATULA MOUTONIANA, *E. R. Lankester.* The Geologist, vol. vi, p. 414, pl. xxi, figs. 1—3, 1863 (not *Terebratula Moutoniana*, D'Orb.).
WALDHEIMIA — *C. A. Meÿer.* Geol. Mag., vol. i, p. 251, pl. xii, figs. 12—14, 1864 (not *T. Moutoniana*, D'Orb.).
— MORRISII, *Meÿer.* Geol. Mag., vol. v, p. 269, 1868.

Spec. Char. Shell oblong-ovate, widest about the middle, deepest towards the posterior portion of the shell. Ventral valve uniformly convex, without sinus; beak incurved, truncated by a moderate-sized foramen, separated from the hinge-line by a small deltidium; beak-ridges well defined. Dorsal valve convex, depressed at the sides, most convex along the middle, and elevated in front. Surface smooth, marked by concentric lines of growth. Loop elongated, extremity of reflected portion angular.

Length 10, width 7, depth $4\frac{1}{2}$ lines.

Obs. This species was described and figured for the first time by Mr. E. R. Lankester in 1863, under the erroneous designation of *Terebratula Moutoniana*, d'Orb., and was subsequently shown by Dr. U. Schloenbach and Mr. Meÿer to be distinguishable from *T. Moutoniana* by its lengthened loop, and from *Waldheimia celtica*, Morris, by the comparatively greater breadth of its valves and by the curvature of the margin, which in *W. Celtica* is always nearly straight.

Position and Locality. *Waldheimia Morrisii* occurs in the Pebble-bed at the base of the upper division of the Lower Greensand at Shanklin, Isle of Wight, also in the upper beds of the Kentish Rag, near Hythe.

60. Waldheimia pseudo-jurensis, *Leymerie*. Sup., Pl. VII, figs. 10—14.

Terebratula	pseudo-jurensis,	*Leymerie.*	Mém. Soc. Géol. de France, vol. v, p. 12, pl. xv, figs. 5, 6, 1842.
—	—	*Matheson.*	Catal., p. 131, 1842.
—	—	*D'Orb.*	Pal. Franç., Terrain Crétacé, vol. iv, p. 74, 1847.
—	—	*De Loriol.*	Desc. des Animaux invert. foss. du Mont Salève, pl. xv, figs. 19—21.
Waldheimia	—	*Walker.*	Geol. Mag., vol. v, p. 405, pl. xviii, figs. 8—10, 1868.

Spec. Char. Shell more or less pentagonal, elongated, and somewhat flattened, broadest posteriorly, attenuated anteriorly; front straight or more or less deeply indented. Dorsal valve moderately convex, depressed, or sinuated near the front; sides rounded or gently incurved towards the front. Ventral valve slightly deeper than the opposite one, with a median sinus near the front, corresponding with a similar depression in the opposite valve. The front and lateral portions of the shell are very much thickened in some individuals, angular and acute in others; beak moderately short, incurved, and truncated by a rather small circular foramen, separated from the hinge-line by a deltidium in two pieces; beak-ridges well defined. Surface smooth, marked by lines of growth; loop elongated and reflected.

Average length 12, breadth 9, depth 5 lines.

Obs. This species, like all its congeners, varies very much in shape, as may be seen by the figures in Plate VII. A good deal of difference is observable in the thickening and degree of indentation of the front, some specimens bearing resemblance in this respect to *Wald. cornuta,* while others have the front line nearly straight.

Position and Locality. In England *W. pseudo-jurensis* occurs in the Folkstone beds of Folkstone and Godalming, and agrees exactly with typical examples from Marolles, in France, as well as with others from the Marnes d'Aszier (Valangian stage), at Aszier (Canton de Vaud), Switzerland. It is very abundant in many localities upon the Continent. The matrix of the Folkstone specimens is entirely silicified, so that by grinding down the external surface of both valves to some depth the loop is completely exposed and may be seen to great perfection through the transparency of the matrix; spines are likewise observable on the front of the loop, as in *W. resupinata* and of many other species. It is very abundant at Upware, and has been found by Mr. Meÿer in the

Pebble-bed of Godalming. Specimens have also been obtained from the Sponge-gravel at Faringdon. In England *T. pseudo-jurensis* appears to occur in the Lower Greensand (= Aptian or Upper Neocomian). It is stated by Alcide d'Orbigny, in his Paléontologie Française,' that on the Continent *T. pseudo-jurensis* characterises the Lower Neocomian, is abundant at Auxerre (Yonne), in the Blue Marls of Saint-Dizier, and at Brettancourt (Haute-Marne), also at Morteau (Doubs), and at Neuchâtel in Switzerland.

61. WALDHEIMIA TAMARINDUS, *Sow.* Dav., Cret. Mon., Pl. IX, figs. 26—31.

In his paper, "Ueber die Brach. aus dem Unteren Gault (Aptien) von Ahans in Westphalen." ('Abdruck aus d. Zeitsch. deutsch. Geol. Gesellschaft,' p. 336, 1866), Dr. U. Schloenbach, jun., enters into lengthened details to show that *W. tamarindus* should be referred to the genus *Megerlia.* He gives at p. 368 an illustration of the loop; but the drawing is evidently incorrect and in no way shows that the shell is really referable to the genus to which he refers it. In a subsequent paper by Mr. C. A. Meÿer in the 'Geol. Mag.,' vol. v, p. 268, 1868, a correct description and figure of the loop are given, which show that it is prolonged to near the front before becoming deflected, and is in no way attached to the central septum. The shell is consequently a true *Waldheimia.* Spinose projections are likewise observable on the edge of the loop in some aged examples.

At Upware the species has attained much larger dimensions than in the Isle of Wight: and Mr. J. F. Walker has described and figured the species from the first-named locality under the following varietal designation:

62. WALDHEIMIA TAMARINDUS, var. MAGNA, Walker. Sup., Pl. VI, figs. 16—19 *a*; and Pl. VII, figs. 5—9 *a* (?).

TEREBRATULA TAMARINDUS, *Sow.*, var. MAGNA, Walker. Geol. Mag., vol. v, pl. xix, fig. 10, 1868.

Waldheimia tamarindus, as was correctly observed by Mr. Walker, varies considerably in form; some specimens assume a somewhat pentagonal shape, while others are more globose and thickened at the margin; so that the Upware examples differ principally from those of the Isle of Wight by their larger size, some specimens having exceeded an inch in width and length, and two thirds of an inch in depth. Internal casts, of great beauty and completeness, occur in the same locality, showing in the most perfect manner the shape and position of the muscular impressions.

Mr. Meÿer doubts very much the occurrence of *W. tamarindus* in the Upper

Greensand of Ireland. It is a common fossil in many Neocomian localities of France, Switzerland, and Germany.

It is with some uncertainty that the specimens from Tealby (pl. vii, figs 5 to 9) are placed with the species or variety under description.

63. Waldheimia (?) Hibernica, *Tate*. Sup., Pl. VII, figs. 21, 21*a*, 21*b*.

Terebratula (Waldheimia) Hibernica, *Tate*. Quart. Journal Geol. Soc., vol. xxi, p. 42. pl. v, fig. 3, 1865.

Spec. Char. Shell small, ovate, longer than wide; valves moderately convex, with a small depression close to the front in the dorsal valve. Ventral valve slightly deeper than the opposite one; beak of moderate size, incurved, and truncated by a circular foramen, separated from the hinge-line by a small deltidium in two pieces. Surface smooth, marked by a few concentric lines of growth. Average length 5, breadth 4½, depth 4 lines.

Obs. The few specimens which I have been able to examine presented in most cases a small depression close to the front, giving to the shell a slightly biplicated appearance. This feature has not been represented in Mr. Tate's figure. The front is rounded in some specimens.

Mr. Tate states that his species is most nearly allied to *W. tamarindus*, but differs from it in its more oblong form, biplication close to the front of the upper valve, smaller foramen, greater development of the deltidial plate, and more obscure beak-ridges. The loop is not known, so that the species is only provisionally placed in the genus *Waldheimia*.

Position and Locality. Common in a compact Chloritic Sandstone in Colin Glen, Ireland, or "Zone of *Exogyra columba*" of the Hibernian Greensand (see p. 46).

64. Waldheimia Juddii, *Walker*. Sup., Pl. VII, figs. 15—18.

Waldheimia rhomboidea, *Walker*. Geol. Mag., vol. v, p. 400, pl. xviii, figs. 3, 3*a*, 3*b*, and 4, 1868.
— Juddii, — Ib., vol. vii, p. 562, 1870.

Spec. Char. Obscurely rhomboidal, longer than wide; valves equally convex or deep; greatest breadth of the shell near the middle, thence gradually tapering towards the beak and front. Ventral valve uniformly convex, without sinus; beak small, incurved, and truncated by a moderately sized foramen; deltidium small; beak-ridges sharply defined; dorsal valve regularly convex to about half its length from the umbo, when a rounded mesial fold of small elevation rises gradually and extends to the front;

laterally the shell presents a pinched-in appearance, the margin being flexuous and curved in front. Surface smooth, marked by concentric lines of growth; loop long extending to within a short distance of the front before becoming reflected.

Length 12, width 9, depth 7 lines.

Obs. In 1870 Mr. Walker found it necessary to alter the name he had originally given to the species to that of *Juddii*, from its having been discovered that the designation of *rhomboidea* had been previously applied by Biondi in 1855 to an Italian Tertiary species. Its nearest allies are *Wald. Morrisi* and *W. tamarindus;* but from both of these it seems distinguishable by its more elongated form, as well as by the pinched-in appearance of the frontal portion of the shell. Internal casts show a deep slit in the dorsal valve, extending to a little in advance of one third of the length of the valve. The loop is similar to that of *W. Morrisi.*

Position and Locality.—Very abundant in the Lower Greensand at Upware; Mr. Meÿer found it at Godalming associated with *T. extensa,* and also in the Sponge-gravel at Faringdon.

65. Waldheimia Wanklyni, *Walker.* Sup., Pl. VII, figs. 22—28.

Waldheimia mutabilis, *Walker.* Geol. Mag., vol. v, p. 400, pl. xix, figs. 4, 5, 1868; and vol. vii, p. 562, 1870.

Spec. Char. Much elongated, oval; valves moderately convex, somewhat flattened, with hardly any fold or sinus, deepest and most convex near the umbo; greatest breadth of the shell about the middle, tapering towards the extremities. Beak short, slightly rounded, and truncated by a rather small foramen, separated from the hinge-line by a wide deltidium in two pieces; beak-ridges sharply defined, leaving a flattened space between them and the hinge-line; front margin nearly straight, edges sharp. Surface smooth, marked by concentric lines of growth. Loop long. Two specimens measured:

Length 21, width 15, depth 7 lines.
„ 21 „ 17 „ 7 „

Obs. Mr. Walker describes what he considers to be two varieties of this species under the designations of var. *elliptica* and var. *angusta.* The first (figs. 22—25) is the largest and most ovate; the second (figs. 26—28) very much elongated and narrow, when compared with its length; but they seem to merge one into the other. A very fine series of specimens may be seen in the Woodwardian Museum, Cambridge.

Position and Locality. This species occurs in the Lower Greensand at Upware, and has likewise been found by Mr. Meÿer in the "Folkstone beds" at Shanklin and Godalming, also in the Sponge-gravel at Faringdon. A specimen of the var. *angusta* in the Woodwardian Museum shows that the loop was exactly similar to that of the var. *elliptica.*

Finding that the name *mutabilis* had been already made use of by Dr. Oppel for another species in his paper on the "Unter-Lias von Hierlatz" (13th vol. of the 'Deutschen Geolog. Gesellschaft,' p. 538, 1861), Mr. Walker wishes to alter the name he formerly gave to this species to that of *Wanklyni*, after Mr. A. Wanklyn, Fellow of Sidney College, Cambridge, who has devoted much attention to the microscopical condition of the shell of many of the species that occur at Upware.

66. Waldheimia Woodwardi, *Walker*. Sup., Pl. VI, figs. 1—5*a*.

Waldheimia Woodwardi, *Walker*. Geol. Mag., vol. iv, p. 455, pl. xix, fig. 3, 1867; and vol. v, p. 404, 1868.

Spec. Char. Shell elongated, oval; ventral valve very convex, strongly keeled, lateral portion of the valve flat or slightly concave, much arched and incurved at the beak. Beak short, and truncated by a moderate-sized foramen lying close to the umbo and partly margined by two small deltidial plates; beak-ridges sharply defined. Dorsal valve more or less deeply depressed or concave, and slightly channelled along the centre; convex laterally and at the umbo. Margin curved, especially in front; Surface smooth, marked by a few fine concentric lines of growth. Loop extending nearly to the frontal margin.

Length 21, width 12, depth 10 lines.

Obs. This fine species was discovered and well described by Mr. Walker in 1867. In his paper on the deposit at Upware (Geol. Mag. vol. iv, p. 310) he had referred it to *T. hippopus*, Roemer, but subsequently found that it differed from Roemer's species as well as from other known Cretaceous forms, and therefore named it after the late Dr. S. P. Woodward. It approaches nearest to some specimens of *W. carinata*, Lam.; and many young specimens can scarcely be distinguished from the Jurassic *W. impressa*. Mr. Walker states that it cannot be confounded with *W. celtica* on account of the shape of its dorsal valve. Internal casts are occasionally met with, and present a singular appearance (fig. 5). In the cast of the dorsal valve there exists a median fissure, which extends to about one third of the length of the valve, and thus indicates the presence of a small median septum. On either side are the muscular impressions, likewise margined by a deepish groove. In some specimens the greatest breadth is in the anterior portion of the shell, while in others it is the reverse.

Position and Locality.—This species is not abundant in the Lower Greensand at Upware. Very fine specimens may be seen in the Woodwardian Museum, Cambridge, and in the collection of Mr. Walker, who, moreover, has deposited in the British Museum a series of all the typical specimens described by him from Upware. Mr. Meÿer informs me that he has picked up some fragments of this species at Godalming.

67. Waldheimia hippopus, *Roemer*, sp. (?), Var. *Tilbyensis*. Sup., Pl. VI, figs. 10, 11.

Terebratula hippopus, *Roemer*. Norddeutsche Kreide, p. 114, pl. xvi, fig. 28; Hils-conglomerat Berklingen, 1841.
— — *Judd*. Quarterly Journal Geol. Soc., vol. xxiii, p. 245, 1868.

Spec. Char. Shell circular or elongated oval, widest about the middle, more or less ventricose, and thickened laterally. Dorsal valve convex at the umbo and along the lateral portions of the valve, gradually concave or longitudinally furrowed along the middle; ventral valve much deeper and more convex than the opposite one, longitudinally keeled and flattened at the sides. Beak much incurved and truncated by a minute foramen, slightly separated from the hinge-line by a deltidium in two pieces; beak-ridges acutely defined, leaving between them and the hinge-line a narrow concave space. Surface smooth, marked only with concentric lines of growth. Loop extending to near the front before becoming deflected.

Length 6, width 5½, depth 4 lines.

Obs. In 1841 Roemer figured and described under the name of *hippopus* a small and well-characterised shell occurring plentifully in the Upper Salzgitter Hills in Hanover. The larger number of specimens of Roemer's species that have fallen under my observation were much thickened, elongated oval, and not much exceeding seven lines in length by five in breadth, and with the sinus very much restricted to the longitudinal central portion of the valve. Among the specimens, however, there did occur a few in which the length and width were nearly equal and the sinus much more broadly concave or dilated.

As is usually the case when a description and illustration is taken from a simgle specimen, it is not easy to appreciate the general character pertaining to the species, or rather the modifications in shape it is capable of assuming; hence if a number of large and totally different forms which have been referred by different Palæontologists to the small Salzgitter shell. As justly observed by M. de Loriol in a note he has added to page 105 of Pictet's description of the Cretaceous Brachiopoda from the neighbourhood of Sainte-Croix, "the German authors have on several occasions pointed out this error (see Strombeck, 1861; 'Ueber den Gault in N. W. Deutschland, Zeitschrift der Deutschen Geol. Gesell,' 1861, p. 45; Herm. Credner, 'Brachiopoden der Hilsbildung, Zeitsch.' &c., 1864; also Schloenbach, 'Leonh. und Bronn's Neues Jahrbuch,' 1866, p. 575. 'Kritische Studien über Kreide-Brachiopoden,' 1866, p. 33, and 'Brachiopoden der Norddeutschen Cenoman-Bildungen,' p. 94). They even see two species in those figured by D'Orbigny under the false name of *T. hippopus:* the one represented by figures 12, 13, 14, of Pl. 508 of the Paléontologie Française; the other corresponding to figures 15—18

of the same plate: Schloenbach has given to this last the name of *Tereb. Strombecki;* it is the one which M. Pictet has described under the name of *Tereb. hippopus.*" I entirely coincide with Dr. U. Schloenbach and M. de Loriol in the view they have taken of this matter; and I am even not quite certain whether the Tealby specimens referred by Mr. Judd to *T. hippopus* really belong to that form, although some specimens approach it more than any others I have seen.

It must be allowed that the many specimens I have been able to examine of the typical form from the Upper Salzgitter Hills, in Hanover, have presented a peculiar appearance not observable in the Tealby specimens referred to that species. They bear much more resemblance to the shell described and figured by Dr. U. Schloenbach in 1868 ('Ueber die Norddeutschen Galeriten-Schichten und ihre Brachiopoden-Fauna,' p. 31, pl. ii, figs. 10—12), under the name of *Terebratula* (?) *defluxa,* and it is possible that the British form might be more properly placed under that species. Anyhow, it is desirable to add a provisional varietal designation after the name *hippopus,* as none of our British specimens entirely agree with Roemer's type, but represent a larger shell. Some of the Tealby specimens, moreover, bear much resemblance to certain examples of *W. impressa* from the Oxford Clay. Under these circumstances, I have deemed it advisable not to reproduce the synonyma and references (mostly incorrect) that have been published of Roemer's species.

Position and Locality.—This species was discovered in England for the first time by Mr. Judd, who found it rather plentifully in a sandy limestone, provincially known as "Greystone," which he refers to the Middle Neocomian, at Acre House, near Tealby, in Lincolnshire. I have picked up specimens agreeing with the Tealby variety in the Neocomian at Escragnolles (Dept. du Var), France.

68. Waldheimia Walkeri, N. Sp. Sup., Pl. VI, figs. 6—9.

Spec. Char.—Shell nearly circular or moderately elongated, oval. Ventral valve deep, longitudinally keeled, flattened laterally; beak incurved and truncated by a circular foramen; deltidium small, in two pieces; beak-ridges sharply defined. Dorsal valve of small depth, convex at the umbo, broadly concave or sinuated anteriorly; surface smooth, marked at intervals with concentric lines of growth.

Length 13, width 11, depth 8 lines.
" 12 " $11\frac{1}{2}$ " 7 "

Obs.—I am somewhat puzzled how to deal with this shell. It differs from *W. hippopus* and *W. Strombecki* very materially, and, although some exceptional specimens, such as fig. 6, bear a certain resemblance to *W. Woodwardi,* the greater number (figs. 7, 8, and 9) differ from it entirely.

Most of the examples that have fallen under my observation were either nearly circular or slightly elongated oval, with a greater or lesser depression in the anterior portion of the dorsal valve; this depression becoming very small, and even almost obsolete, in some specimens.

Position and Locality.—*Wald. Walkeri* occurs rather abundantly in ironstone beds, referred by Mr. Judd to the Middle Neocomian, at Acre House, near Tealby, in Lincolnshire. A fine series of specimens collected by Mr. Judd may be seen in the Museum of the Geological Survey, also in the Woodwardian Museum, Cambridge. M. Gény and myself found specimens agreeing with those that occur at Acre House, in beds of about the same age, at Papaton and Braus, near Nice, in the South of France.

69. Waldheimia faba, *d'Orb.* sp. Sup., Pl. VI, figs. 12—14*a*.

Terebratula longa, *Roemer.* Ool.-Geb., p. 22, pl. xviii, fig. 12 (from the Hils), 1836.
— — — Kreide-Geb., p. 44, 1841,
— faba, *d'Orbigny.* Pal. Franç., Terrain Crétacé, p. 77, pl. 506, figs. 8—12, 1847 (not *Tereb. faba*, Sow.).
— — *Credner.* Zeitsch. der Deutsch. Geol. Ges., p. 563, pl. xxviii, figs. 3, 4, 5 (from the Hils), 1864.
— longa, *Quenstedt.* Die Brachiopoden; Pet. Deutschland's p. 338, pl. xlvi, figs. 99, 100, 1871.
— (Waldheimia) faba, *Pictet.* Brachiopodes du Terrain Crétacé de Ste.-Croix, p. 92, pl. cciii, figs. 9, 10, 1872 (not *T. faba*, Sow.).

Spec. Char.—Shell longitudinally oval, broadest anteriorly, tapering to the beaks, nearly straight in front; valves almost equally convex, and deepest near the umbo. Ventral valve moderately convex, beak slightly incurved and truncated by a foramen of smallish dimensions, partly margined on either side by a deltidium in two pieces; beak-ridges sharply defined, leaving a concave space between them and the hinge-line. Dorsal valve either uniformly convex or flattened, and slightly concave anteriorly; front-line straight or moderately curved. Surface smooth, marked at intervals with concentric lines of growth. Average proportions:

Length 13, width 2, depth 9 lines.

Obs.—Alcide d'Orbigny, Pictet, and others are, I think, mistaken when they refer the *Tereb.* (*Waldheimia*) *longa* of Roemer to the *Tereb. faba* of Sowerby. I still consider this last to be a young *Terebratula biplicata*, derived from the Upper Greensand of Warminster, the original specimen being preserved in the Museum of the Geological

Society. I quite agree with M. Pictet that, as Zieten had previously (in 1830)[1] applied the name *Terebtabula longa* to another, although apparently closely allied, species, Roemer's name cannot be retained for the shell under description; and, as I believe Sowerby's *T. faba* to be a *Terebratula,* the designation of *Waldheimia faba,* d'Orbigny, sp., might be retained as a substitute for that of *Ter. longa.*

Waldheimia faba varies considerably in shape, principally on account of the absence or presence of a median depression in the anterior portion of the smaller or dorsal valve. I am quite certain that d'Orbigny's and Roemer's species are the same; for I possess French specimens given to me by Alcide d'Orbigny in 1848, which entirely agree with others from the Hils formation of Germany.

Position and Locality.—*W. faba* occurs in the Middle Neocomian or Speeton Clay at Knapton, in Yorkshire: the specimen figured in Sup., Pl. VI, fig. 12, agreeing in every respect with some of Roemer's examples, was lent to me many years ago by the late Mr. Bean. It has been found likewise in the Middle Neocomian at Acre House, near Tealby, where several good examples have been obtained by Mr. Judd.

Waldheimia faba (*T. longa,* Roemer) is a common fossil in the "Elligser Brinke Schiefer" (Middle Neocomian), near Delligsen, Hanover. In France it is quoted by d'Orbigny from Saint-Dizier (Haute-Marne), and by M. Pictet from the Yellow Neocomian (Middle Neocomian) of Locle, in Switzerland.

RHYNCHONELLIDÆ.

On account of the very great variation in shape assumed by almost every species of the genus *Rhynchonella,* it becomes no easy matter to find characters sufficiently constant by which they can be clearly separated.

I have ventured to divide the British Cretaceous *Rhynchonellæ* into twenty-two species; but it is possible that two or three of them should be considered as varieties of some of the others.

About half the number are peculiar to the Cretaceous deposits above the Gault, and the other half occur in the Lower Greensand or Neocomian. Very few, if any, of the British Cretaceous *Rhynchonellæ* appear with certainty to be common to the two periods.

[1] 'Die Verst. Württembergs,' pl. xxxix, fig. 7.

70. Rhynchonella plicatilis, *Sow.* Dav., Cret. Mon., Pl. X, figs. 37—42.

Var. octoplicata. Pl. X, figs. 1—17.
Var. Woodwardi. Pl. X, figs. 43—46.

Mr. Tate informs me that *Rh. lentiformis* (Woodward), 'C. M.,' Pl. XII, figs. 4, 5, which he (Tate) has catalogued as a variety of *Rh. limbata* (Quart. Journ. Geol. Soc., vol. xxii, p. 30) appears to be the young of *Rh. octoplicata*, and that both occur in the Upper Chalk of the County of Antrim, in Ireland.

71. Rhynchonella limbata, *Schloth.* Dav., Cret. Mon., Pl. XII, figs. 1—5, Upper Chalk.

Var. robusta, *Tate.* Sup., Pl. VII, figs. 18, 18*a*.

Rhynchonella limbata, var. robusta, *Tate.* Quarterly Journal Geol. Soc., vol. xxi, p. 42, pl. v, fig. 2, 1865.

Mr. Tate observes that this well marked variety of *Rh. limbata* is very distinct on account of the exceeding gibbosity of the shell. It is very common in the Upper Greensand or Hibernian Greensand ('Zone of *Inoceramus Crispi*' of R. Tate) at Woodburn, near Carrickfergus (Country Antrim), Whitehead, and Island Magee. It was also found by Mr. Judd in the same Zone at Waterloo, near Larne. It may be noted that, although possessing the general aspect of *Rhyn. limbata,* all the specimens I have been able to examine were so much more circular and gibbous than *Rh. limbata* as occurring in the Upper Chalk, that it might perhaps constitute a separate species under the designation of *Rh. robusta,* Tate. This species (or variety of *R. limbata*) seems to be restricted to the Upper Greensand, while *Rh. limbata* proper occurs (even in Ireland) in the White or Upper Chalk.

72. Rhynchonella Martini, *Mantell.* Dav., Cret. Mon., Pl. XII, figs. 15, 16.

Specimens from the Chalk-marl of Watlington, Oxon; and Grey Chalk of Dover.

73. Rhynchonella Grasiana, *d'Orb.* Dav., Cret. Mon., Pl, XII, figs. 17, 19.

Specimens from Folkstone, the Upper Greensand of Warminster, Brauscombe, and the

Isle of Wight. It is very abundant in rocks of the same period at Vivortier (Orne) and other places in France. M. Pictet describes it as from the Upper Gault (our Cambridge Upper Greensand) of St.-Croix in Switzerland; and it has also been met with by Dr. Geinitz in the Upper Greensand of Saxony.

74. Rhynchonella Mantelliana, *Sow.* Dav., Cret. Mon., Pl. XII, figs. 20—23.

Specimens from Lower Chalk, Chalk-marl, and Upper Greensand or Chloritic Marl; also Red Chalk, Speeton (Rev. T. Wiltshire). It occurs in the Lower Chalk of La Cadière (Dept. du Var), France. Dr. Geinitz describes and figures it from Saxony.

75. Rhynchonella Cuvieri, *d'Orb.* Dav., Cret. Mon., Pl. X, figs. 50—54.

Specimens from the Lower Chalk of Watlington, Oxon. In France it is a common fossil in the Chalk with *Micraster cor-testudinarium.*

76. Rhynchonella sulcata, *Park.* Dav., Cret. Mon., Pl. X, figs. 18—20, 21 and 22? and 23—36.

I am somewhat uncertain with reference to the specimens figs. 21 and 22, which the late Mr. Bean found in the "Speeton Clay." In the Museum of the School of Mines there are some fine examples from the Lower Greensand Folkstone; and I am informed by Mr. Meÿer that this species occurs in the Lower Chalk of Croydon and Guildford, but I have not seen specimens from those localities. The shell is most abuudant in the Upper Greensand of Cambridge ('Étage Vraconien,' or Upper Gault, of Renevier and Pictet). It occurs also in the Red Chalk of Hunstanton; and I have found it equally abundant and characteristic in beds of the same period at Ese between Nice and Monaco. Pictet quotes it from the Upper Greensand of Saint-Croix (Switzerland); from the Gault of the Perte du Rhône and the Grand Bernard; the Col de Cheville; the Upper Gault of Cosne (Nièvre) and Valbonne (Gard).

77. Rhynchonella depressa, *Sow.* Dav., Cret. Mon., Pl. XI, figs. 28—32; Pl. XII, fig. 26 (not 28—30?); Sup., Pl. VIII, figs. 24, 24 *a*, 25.

In Pl. XI were represented Sowerby's typical forms of *Rh. depressa*, which, as has been

shown by Mr. Meÿer and others, are referable to the age of the Lower Greensand, and not to that of the Upper Greensand, as I had formerly erroneously supposed the Sponge-gravel at Faringdon to belong. Mr. Meÿer is of opinion that Sowerby's *Rh. depressa* is quite distinct from any forms that occur in the Upper Greensand of Warminster, and, if this view be correct, the shells I figured in Pl. XII, figs. 28, 29, 30, should be referred to another species.

Sowerby's *Rh. depressa* has, both on the Continent and in this country, been made a convenient receptacle for several forms that could not be clearly distinguished; hence much confusion has arisen, which it will be no easy matter to dispel.

A large variety of Sowerby's species (figs. 24, 25), very variable in shape, occurs abundantly in the Lower Greensand at Upware; and, indeed, in this locality the greater number of forms, which occur likewise at Faringdon, have attained larger proportions, together with a strong varietal aspect. *Rh. depressa* is stated by Mr. Meÿer to be found also at Godalming.

78. Rhynchonella Schloenbachi. Dav., Cret. Mon., Pl. XII, figs. 28, 29, 30.

Rhynchonella depressa, varr. A & B, *Dav.* Cret. Mon., pl. xii, figs. 28—30.

At pages 91 and 92 of my Monograph, I stated that the specimens figs. 28, 29, and 30, "appear to constitute (if not a separate species) well-marked varieties of *Rh. depressa* of Faringdon;" consequently I described them under the head of "Varieties A" and "B." Since then I have had the opportunity of examining a great number of specimens from the Upper Greensand near Belfast, where the shell occurs in the "Zone of *Exogyra columba;*" also from Vivortier, in the Dept. de l'Orne; and I am now disposed to agree with Mr. Meÿer that this shell can be specifically distinguished from the true *Rh. depressa* as occuring in the Lower Greensand of Faringdon.

The variety "A," with fewer and larger ribs (fig. 30), and the variety "B," with smaller and more numerous ones (figs. 28, 29), seem to graduate one into the other. Perhaps Schloenbach's *Rhynch. sigma* may be a modification of the shell under description.

Position and Locality. In addition to Chardstock, Mr. Meÿer has found this species in the Upper Greensand of Niton, Isle of Wight; Pinhay Cliff, near Lyme Regis; at the base of Upper Greensand, near Beer Head; and in Chloritic Marl at Dunscombe.

79. Rhynchonella lineolata, *Phillips.* Dav., Cret. Mon., Pl. XII, fig. 6.

Of this species, as found in the Speeton Clay (Neocomian) of Knapton, in Yorkshire,

strange to say, no other example appears to have been discovered than the one picked up by Mr. Bean some time previous to 1835.

In 1855 I described and figured, under the above designation, a much smaller shell, which occurs very abundantly in the Upper Greensand of Cambridge, and of many other places. It is very persistent in its smaller proportions; and the longitudinal radiating striæ which cover the surface of both valves are likewise much stronger or coarser, in comparison with those in the typical *T. lineolata* of Phillips. Mr. Meÿer and some other Palæontologists have consequently expressed themselves uncertain whether the two forms should be united in a single species; and it became quite evident that the Cambridge shell should be distinguished, at any rate, by a varietal designation.

80. RHYNCHONELLA LINEOLATA, Var. CARTERI. Dav., Cret. Mon., Pl. XII, figs. 7—10.

This variety has, for many years, been labelled *Rh. Carteri* on a tablet in the British Museum. It has also been figured and described under the name of *Rh. lineolata* by Dr. Schloenbach in 1867 (' Uber die Brach. der Norddeutsch. Cenoman-Bild. Geognost.-Pal. Beiträge,' vol. i, p. 493, pl. xxiii, fig. 4); also by Pictet in his ' Brach. du Terrain Crétacé de St.-Croix,' p. 48, pl. cc, fig. 14, 1872. Dr. H. B. Geinitz names it likewise *Rh. lineolata* in his ' Das Elbthalgebirge in Sachsen,' pl. xxxvi, fig. 36, 1872.

This variety, which occurs so plentifully in the Upper Greenand of Cambridge, has been found, with the same small proportions and other characters, in beds of a similar age in Germany and Saxony. M. Pictet quotes it from the Gault of Switzerland, and I have found it in Upper Neocomian beds at Drap and Layet, near Nice, in the South of France; hence it would seem to have enjoyed a rather extended geological range. The Rev. T. Wiltshire has found this form in the Red Chalk of Speeton.

RHYNCHONELLA DIMIDIATA, *Sowerby*.

In his memoir, ' Ueber die Brach. der Norddeutsch. Cenoman-Bildungen,' p. 486, 1867, Dr. Schloenbach insists that the specimens I have drawn in Pl. XI, figs. 1 to 14, and Pl. XII, figs. 24, 28, 29, 30, are all referable to a single species, namely, *T. dimidiata*, Sow. Dr. Schloenbach may be correct in the view he has taken (with the exception of those in Pl. XII, figs. 28—30); but, if so, then an unusually great variability must be conceded to the species under description; for it would be made to include forms differing very considerably in shape and sculpture, individuals with strong ribs and others with numerous small ones being all combined under a single denomination. When describing the shells alluded to by Dr. Schloenbach I remember feeling greatly puzzled, and some uncertainty may still prevail.

In 1855 I followed d'Orbigny and some other Palæontologists while referring the shells Pl. XI, figs. 1—5, and Pl. XII, fig. 25, to one of the supposed varieties of *Rh. compressa*, Lamarck, sp. D'Orbigny observes, at p. 37 of his 'Paléontologie Française,' that there appear to be two varieties of *Rh. compressa* in the Upper Greensand of Le Mans—one, depressed (Lamarck's type); the other, narrower and more convex; a more transverse variety of the same being likewise found at Havre, which would hold an intermediate position between the two varieties occurring at Le Mans. In England we do not find the depressed form of the Mans or true *T. compressa* of Lamarck, our species being exceedingly variable and at the same time identical with that occurring at Havre; it is the *T. dimidiata*, Sow. = *T. alata* and *gallina*, Brongniart = *T. dilatata*, Sow., &c.

Therefore, in order to avoid further confusion, it may be advisable to retain the name *dimidiata*, Sow., for the forms to which I had applied the name of *compressa*, and to add the varietal designation of *convexa* (Sow.) to those specimens, from Warminster, referred to *Rh. compressa*, Lamarck; but, at the same time, it must be admitted that intermediate forms may be collected in the same locality, which seem to connect, to a greater or lesser extent, the varieties *dimidiata* and *convexa*.

81. Rhynchonella dimidiata, *Sow.* Dav., Cret. Mon., Pl. XI, figs. 1—5; Pl. XII, fig. 25.

Rhynchonella compressa, *Dav.* Cret. Mon., p. 80, pl. XI, figs. 1—5; pl. XII, fig. 25.

This would agree well with *Rh. dimidiata*, Sow. (*Rh. alata* and *gallina*, Brong.). When symmetrical, it is the form to which the last two names had been given, and when distorted or unsymmetrical it would be the shell described as *dimidiata*, Sow. Many species of *Rhynchonella* have their valves occasionally unsymmetrical, the mesial fold becoming totally or partially shifted either to one side or the other. This is often the case with *Rh. sulcata*, *Rh. difformis*, *Rh. lata* or *latissima*, *Rh. antidichotoma*, and many other forms. When perfectly well shaped, *Rh. dimidiata* is transverse and laterally expanded. The surface is marked with about forty strong ribs, of which some nine or ten form a wide, slightly raised, but flattened, mesial fold.

This species occurs in the Upper Greensand of Warminster; in the cliffs near Lyme Regis, at Beer Head, &c.; in the Chloritic Marls or Discoidea- and Scaphites-beds of Chard and Chardstock; in the Upper Greensand of the Undercliff, Isle of Wight, &c.

82. Rhynchonella dimidiata, Var. convexa, *Sow.* Dav., Cret. Mon., Pl. XI, figs. 6—14; and Pl. XII, fig. 24.

Rhynchonella latissima, *Dav.* Cret. Mon., p. 82, pl. xi, figs. 6—14; and pl. xii, fig. 24 (not *R. lata*, or *latissima*, Sow. ?).
Terebratula convexa, *Sow.* Fitton, Trans. Geol. Soc., 2nd ser., vol. iv, pl. xiv, fig. 12.

This variety is far less transverse than the preceding one, being at the same time more convex. The mesial fold is scarcely raised, and the shell is marked by as many as sixty small radiating ribs when full grown. Some specimens, such as the one I represented by Pl. XI, fig. 13, present the small ribs of the variety *convexa* up to two thirds of the length of their valves, when, after a pause or interruption, the ribs become suddenly fewer and considerably stronger and larger. Specimens with this variation in shape and character are very abundant in the same localities where the typical form occurs. I cannot agree with Dr. Schloenbach when he proposes to consider the small shell, Pl. XII, figs. 28, 29, 30, from Chardstock as another variety of *Rh. dimidiata.*

The variety *convexa* is very abundant in the Upper Greensand of Warminster. A smaller and more gibbous form of the same is plentiful in the Hibernian Greensand (Upper Greensand) or 'Zone of *Inoceramus Crispi*' at Woodburn, near Carrickfergus, County Antrim, and at Moneymore, County Derry, Ireland, where it has been collected by Messrs. Tate, Judd, and others.

83. Rhynchonella (lata) latissima, *Sow.* Dav., Cret. Mon., Pl. XI, figs. 15—22 (not 6—14, nor Pl. XII, figs. 24, 28, 29, 30).

Mr. Meÿer is of opinion that the typical and true *Rh. latissima*, Sow., from the Faringdon Sponge-gravel is distinct from the so-termed *Rh. latissima* (*dimidiata*) of Warminster and Le Mans; also that it is distinct from d'Archiac's figures, which most probably represent *Rh. dimidiata.* He adds that it would not only be safe but proper to separate entirely Sowerby's Faringdon species *Rh. latissima, Rh. depressa,* and *Rh. nuciformis* from any other forms that occur in the Chloritic beds or so-called Upper Greensand of Chard, Chardstock, Warminster, the Isle of Wight, &c.; and he even doubts whether there are any English species of Brachiopoda common to beds below and above the Gault. If my distinguished friend be correct in this respect, I cannot help observing that many specimens I have picked up at Warminster, if not specifically

identical, at any rate very closely simulate some of the forms of *Rh. latissima* I have collected at Faringdon. Indeed, considerable confusion has prevailed upon the Continent in the attempt to identify some of their forms with Sowerby's species. Thus, for instance, d'Orbigny's *Rh. lata* is not the *lata* or *latissima* of Sowerby as found at Faringdon, and will require to take another name.

Rh. lata is also the *Rh. antidichotoma* of Sharpe, but not of Buvignier.

84. Rhynchonella multiformis, *Roemer*. Sup., Pl. VIII, figs, 22, 22*a*, 23.

Terebratula depressa, *von Buch*. Ueber Tereb., p. 38, 1834 (non Sow.).
— — *Nicolet*. Mém. Soc. Neuchâtel, vol. ii, p. 8, 1839.
— multiformis, *Roemer*. Nord-Deutsche Ool. Suppl., p. 19, pl. xviii, fig. 8, 1839; Nord-Deutsche Kreide, p. 37 (From the Hils), 1841.
— rostralina, — Ool. Suppl., p. 20, pl. xviii, fig. 7, 1839.
— depressa, — Kreide, p. 38, 1841.
— rostralina and rostrata, *Leymerie*. Mém. Soc. Géol. de France, vol. v, pp. 18, 30, pl. 15, fig. 11 (from the étage Néocomien), 1843.
— depressa, *Favre*. Mont Salève, p. 35, 1843.
Rhynchonella — *Marcou*. Jura Salinois, p. 139 (from the zone of the marls of Hauterive with Coralline facies), 1846.
— — *D'Orb*. Pal. Fr., Terr. Crét., vol. iv, p. 491, figs. 1—7 (synonyma in part excluded), 1847; Prodrome, vol. ii, p. 54, 1850.
Terebratula — *Geinitz*. Quadersandstein, p. 206 (from the Hils) 1850.
Rhynchonella — *Cornuel*. Bull. Soc. Géol. Fr. sér. 2, vol. viii, p. 436 (from the Calcaire à Spatangus), 1851.
— — *Buvignier*. Stat. Géol. de la Meuse, p. 474 (ib.), 1852.
— — *A. Gras*. Foss. de l'Isère, p. 31 (from the Neocomian), 1852.
— — *Studer*. Geol. der Schweiz, vol. ii, pp. 71 and 281 (from the Calcaire à Spatangus), 1853.
— — *Tribolet*. Bull. Soc. Neuchâtel, vol. iv, p. 76 (from the Middle Neocomian), 1856.
— — *Cotteau*. Moll. foss. Yonne, p. 128 (from the Neocomian), 1856.
— — *Étallon*. Esquisse du Haut-Jura, pp. 42 and 83 (id.), 1857.
— — *Mortillet*. Géol. et Min. de la Savoie, p. 229 (id.), 1858.
— — *Desor. et Gressly*. Études Géol. sur le Jura Neuchâtelois, pp. 31 and 38 (from the Urgonian and Middle Neocomian), 1859.

RHYNCHONELLA MULTIFORMIS, *P. de Loriol.* Desc. An. inv. Mont Salève, p. 113, pl. xv, figs. 23—26 (Middle Neocomian), 1861.
— — *Ooster.* Pétrificat. remarquables des Alpes Suisses, Brachiopodes, p. 54, 1863.
— DEPRESSA, — Id., p. 55, pl. 19, figs. 11, 12, 1863.
TEREBRATULA — *Quenstedt.* Petref. Deutsch., Brachiop., p. 155, pl. xli, figs. 1—8 (9—13 excluded), 1868.
RHYNCHONELLA MULTIFORMIS, *Jaccard.* Desc. Géol. du Jura Neuch., pp. 150 and 158 (Matér. pour la Carte Géol. de la Suisse, 6 liv.), 1869.
— — *Pictet.* Desc. des Foss. du Terrain Crétacé de Sainte-Croix, Brachiopodes, p. 10, pl. cxcv, figs. 1—8, 1872.

Spec. Char. Variable in shape, generally wider than long, ventral valve moderately convex, with a wide sinus occupying about one third of the anterior half of the valve; beak pointed, moderately produced, and incurved; foramen rather small, surrounded and separated from the hinge-line by a deltidium; hinge-ridges well defined, leaving a flattened space between them and the hinge-line. Dorsal valve much deeper than the opposite one, evenly convex to about half the posterior half of valve, at which point the mesial fold gradually rises, so that the anterior half of the valve is divided into three portions. Surface of each valve marked with from twenty to thirty angular ribs, of which from six to eight occupy the fold. Proportions very variable. Two specimens measured—

Length 13, width 16, depth 8 lines.
,, 10, ,, 11, ,, 8 ,,

Obs. I entirely coincide with what is stated by M. Pictet in the following passage taken, as well as the synonyma above given, from his description of *Rh. multiformis:* "L'existence de cette espèce, si abondante dans l'étage néocomien, a été pour la première fois signalée par de Buch, qui crut devoir la réunir à la *Rh. depressa* de Sowerby. Agassiz, dans la traduction de Sowerby (1845, p. 517), dit: 'On identifie ordinairement avec cette espèce (*depressa*) celle qui est si commune dans le Néocomien de Suisse et de France. Pour décider de leur identité, il faudrait pouvoir comparer des séries provenant de divers localités.' Cette association a été généralement acceptée par les auteurs jusqu'à ces dernières années, et en particulier par d'Orbigny; mais, depuis les travaux classiques de Mr. Davidson, on connait la vraie *Rh. depressa* et l'on sait qu'elle diffère d'une manière notable de l'espèce néocomienne. M. de Loriol a montré que cette dernière a été décrite, en 1839, par Roemer sous les noms de *multiformis* et de *rostralina,* et il a proposé, avec raison, de lui rendre la première de ces dénominations." As its name implies, the shell assumes many shapes, some specimens being even elongated. The smallness of its foramen and much stronger ribs seems to distinguish it from *Rh. depressa.*

Position and Locality. Rh. multiformis was found by Messrs. Judd and Keeping in the

Middle Neocomian at Acre House, near Tealby, in Lincolnshire; and of these good examples may be seen in the Museum of the School of Mines, London, and in the Woodwardian Museum at Cambridge.

It is a very abundant fossil upon the Continent. Very large examples occur in the Hilsthon, Elligser Brinke Schist (Middle Neocomian of Elligser Brinke, near Delligsen, Hanover), also in the Hils Conglomerate of Schœppenstedt, Æselberg, and the Grosse Vahlberg, Brunswick; in the Marnes d'Hauterive, at Villers-le-lac, Cressier, Landeron, Locle, Mont Saléve in Switzerland; in the Middle Neocomian of Morteau (Doubs), of Auxerre, Mozeroy (Jura), Saint Dizier, and many other places.

85. Rhynchonella antidichotoma, *Buv.*, sp. Sup., Pl. VIII, figs. 19—21.

Terebratula antidichotoma, *Buvignier*. Mém. de la Soc. Philom. de Verdun, 2, p. 13, pl. v, fig. 7, 1843.
Rhynchonella — *D'Orb.* Pal. Franç., Terr. Crétacés, p. 31, pl. 500 *d*, figs. 1—4, 1847.

Spec. Char. Transversely oval. Ventral valve slightly convex, and flattened to about half its length. Sinus broad, occupying rather more than one third of the anterior half of the valve. Posterior half of the shell tapering on each side to a pointed and slightly incurved beak. Foramen oval, surrounded and separated from the hinge-line by a deltidium; beak-ridges very sharply defined, leaving a rather wide flattened space between them and the hinge-line. Dorsal valve much more convex and deep than the opposite one; fold broad, occupying rather more than a third of the posterior half of the valve. Half or more than two thirds of the surface of each valve from the beak is marked by numerous small rounded radiating ribs, fifty or fifty-five in number, which, after an interruption in the growth of the shell, are succeeded by from twelve to seventeen large projecting angular ones, of which from four to six compose the mesial fold or sinus. The surface of the valves is also crossed by numerous concentric lines of growth. The mesial fold and sinus is also, in some specimens, twisted or shifted from the centre to one of the lateral portions of the valve so as to give the shell an unsymmetrical appearance.

Length 1 inch 2 lines, width 1 inch 5 lines, depth 10 lines.

Obs. This fine species varies a good deal in shape, some specimens being much more convex than others. It has been well described and figured by both Buvignier and d'Orbigny.

Position and Locality. It occurs in the Lower Greensand at Upware and Potton, and was found by M. Buvignier, in the "étage albien" of Grandpré (Ardennes), and by M. d'Orbigny at Novion.

86. Rhynchonella nuciformis, *Sow.*, sp. Dav., Cret. Mon., Pl. XI, figs. 23—27 (not Pl. XII, fig. 27).

Mr. Meÿer considers the Lower-Greensand *Rh. nuciformis*, to be nearly allied to *Rh. Gibbsiana*, and quite distinct from any of the Upper-Greensand shells found at Warminster; the greatest thickness in the Faringdon specimens being situated near the front, and the greatest thickness of the so-called *Rh. nuciformis* of Warminster being nearer the hinge. The ribs are rounded also. Specimens have been found at Faringdon and Shanklin; but I am not aware of this species having been met with at Upware.

87. Rhynchonella Wiestii, *Quenstedt*, sp. Sup., Pl. VIII, figs. 31, 31*a*, 31*b*.

Terebratula Wiestii, *Quenstedt*. Petref. Deutschlands, Brachiopoda, p. 166, pl. xli, fig. 52—54, 1871.

Spec. Char. Almost circular, slightly wider than long; valves almost equally convex or deep; mesial fold in dorsal valve of small elevation, commencing to rise at about half the length of the valve; sinus in ventral valve shallow; beak slightly produced; foramen small, surrounded and separated from the hinge-line by a projecting tubular-shaped deltidium; beak-ridges strongly marked, leaving a flattened space between them and the hinge-line. Surface of each valve ornamented by about thirty or thirty-two rounded ribs, of which some six form the mesial fold.

Obs. The species to which this shell most nearly approaches is the *Rh. Grasiana* d'Orb., of which it may, perhaps, be a large variety.

Position and Locality. Rh. Wiestii occurs, along with *Rh. Grasiana*, in the Chloritic Marl (Upper Greensand, beds "2" and "3" of Wiest) at Chardstock. It was also found by Mr. Meÿer in the same formation at Beer Head.

88. Rhynchonella Upwarensis, *Dav.* Sup., Pl. VIII, figs. 27—28*b*.

Spec. Char.—Shell transversely oval, widest about the middle; deep, gibbous, much thickened at the frontal and lateral margins. Dorsal valve very convex, forming in profile an elevated convex curve to within two thirds of its length, when it becomes suddenly geniculated or bent, so as to meet the lateral and frontal margins of the

opposite valve. The dorsal valve is also uniformly convex to about half its length from the umbone, and then divides into three portions by the gradual rise of a wide, slightly convex, mesial fold. Ventral valve moderately convex, with a deep, wide, median sinus, beginning at about one third of the length of the valve from the beak; the remaining third being rather abruptly bent so as to meet the serrated margin of the dorsal one. Front much thickened, flat, or forming a moderate or very deep concave inward curve, with sharp lateral angles. Beak moderately produced, leaving a flattened space between its ridges and the hinge-line; foramen small, situated under the pointed, slightly incurved beak, and margined by a narrow deltidium. Surface of each valve marked by a variable number of small angular ribs (from sixty to seventy), longitudinally indented near the margin and crossed by numerous concentric lines of growth which become more numerous as they approach the margins.

Proportions variable; a large specimen measured, length 10, width 12, depth 10 lines.

Obs. This species somewhat approaches in shape and character the *Rhynchonella Valangiensis,* de Loriol, from the Étage Valangien (Neocomian) of Arzier in Switzerland. Our species is larger, more transverse, (wider than long), and more obtuse at its beaks than the Swiss shell; this last has also a median depression in the mesial fold not observable in any of the many specimens of the Upware species that have fallen under my notice. In common with *Rh. Valangiensis* it sometimes presents that singular frontal indented curve which we have endeavoured to represent in fig. 28.

Position and Locality. Exceedingly abundant in the Lower Greensand of Upware; some large and fine examples may be seen in the Woodwardian Museum, Cambridge, and in the collection of Mr. Walker at York.

89. Rhynchonella Gibbsiana, *Sow.* Dav., Cret. Mon., Pl. XII, figs. 11, 12.

According to Mr. Meÿer this shell occurs at Faringdon among the varieties of *Rh. nuciformis.* Specimens have been found in the Lower Greensand of Folkestone, Hythe, and Shanklin. A variety resembling *Rh. lata,* D'Orbigny (not Sow.), 'Pal. Franç. Terrains Crétacés,' pl. ccccxci, fig. 14, occurs at Upware, as well as in the Perna-bed at Atherfield, Redcliff, Shalford, and Sevenoaks. D'Orbigny has confounded two species in his so-termed *Rh. lata* of Sowerby.

90. Rhynchonella parvirostris, *Sow.* Dav., Cret. Mon., Pl. XII, figs. 13, 14; Sup., Pl. VIII, figs. 29, 29*a.*

Lower Greensand, Shanklin, Isle of Wight.

91. Rhynchonella Cantabrigensis, *Dav.* Sup., Pl. VIII, figs. 30, 30*a*, 30*b*.

Spec. Char. Obscurely deltoid, about as broad as long, greatest breadth towards the posterior portion of the shell, tapering posteriorly to the extremity of the beak. Dorsal valve convex or gibbous, divided into three portions, of which the central one forms a convex mesial fold. Ventral valve very slightly convex or flattened, of small depth, and divided by a broad mesial sinus, which deepens as it nears the front. Front deeply sinuated; beak slightly produced; foramen small, situated under its gently incurved angular extremity, and borderèd by a narrow deltidium. A flattened space exists between the beak-ridges and hinge-line. Surface of each valve marked by from twenty-four to twenty-eight angular ribs, which are, in some specimens, stronger or larger on the lateral portions of the valves than on the fold and sinus.

Length 10,width $10\frac{1}{2}$, depth 8 lines.

Obs. Mr. Walker considers that the species under description is nearest to *Rh. parvirostris*, but more elongated and globose. These and other differences become very apparent when one compares with it true specimens of *Rh. parvirostris* from the Isle of Wight. In *Rh. parvirostris* the greatest breadth of the shell is at or close to the hinge-line, while the beak and its lateral slopes form a broad obtuse angle with their outer extremities turned upwards. In *Rh. Cantabrigensis* the reverse is observable; the beak-slopes merging gradually into the general lateral curve; and while one species is decidedly transverse, the other is about as wide as long.

Position and Locality. Exceedingly abundant in the Lower Greensand at Upware: some specimens agreeing with these have been found in deposits of a similar age at Godalming and the Isle of Wight.

92. Rhynchonella Walkeri, *Dav.* Sup., Pl. VIII, figs. 33, 34.

Spec. Char. Almost circular or about as wide as long. Valves moderately convex; dorsal valve divided into three almost equal portions, of which the central one forms the mesial fold; ventral valve rather less convex than the opposite one, sinus wide, of moderate depth; beak short, incurved, leaving between its ridges and the hinge-line a flattened space; foramen minute, margined and separated from the hinge-line by a narrow deltidium. Surface of each valve marked with from eleven to fourteen strong angular ribs, of which from three to four compose the fold, two to three the sinus.

Length 5, width $9\frac{1}{2}$, depth 5 or 6 lines.

Obs. This species is easily distinguished from any of the other forms that occur in our British Cretaceous rocks by its few and large angular ribs. It was discovered by

Messrs. Judd and Keeping in the Middle Neocomian or Tealby series, at Acre House, in Lincolnshire. The specimens figured are in the Museum of the School of Mines, London, and the Woodwardian Museum at Cambridge.

In the 'Annals and Magazine of Natural History' for December, 1862, I figured in pl. xxiv of that periodical a specimen of *Rhynchonella,* stated to have been found by Mr. R. Dawson in Upper Greensand (?) at Cruden, Aberdeenshire, which much resembles in external appearance the shell under description.

93. Rhynchonella speetonensis, *Dav.* Sup., Pl. VIII, figs. 32, 32*a,* 32*b,* 32*c.*

Spec. Char. Shell somewhat sub-trigonal, as wide as or wider than long, greatest breadth posteriorly. Dorsal valve convex, with a wide, angular, mesial fold. In profile the valve forms a rising convex curve to about two thirds of its length, when it bends again upwards, so that the most elevated portion of the valve is close to the front. Ventral valve slightly convex, of small depth, but forming in profile a strong convex curve. Sinus large, deep, and almost pointed at its extremity; front line W-shaped, but with the lateral branches shortened; beak small, very obtuse, and incurved; foramen minute, margined by a narrow deltidium. Surface of each valve marked by about thirty rounded radiating ribs, which assume a somewhat larger appearance as they approach the frontal portion of the mesial fold and sinus. They are also closely crossed by concentric lines of growth.

Length 9, width 8, depth 6 lines.

Obs. This is a well marked species, remarkable on account of its general shape, and the upward curve of its tapering mesial fold, in which respect it bears some resemblance to *Rh. varians.* The fold also acquires a rather sudden increase in breadth at its anterior termination.

Position and Locality. Several specimens of this shell were obtained by Mr. Leckenby from the Speeton Clay (Neocomian); and an exactly similar shell occurs in the Hilsthon, Elligser Brinke Schist (Middle Neocomian), at Elligser Brinke, near Hanover. German specimens have sometimes been confounded with *Rh. varians,* Roemer.

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23	— megatrema (*Sow.*), Dav. C. M., pl. xii, figs. 31, 32, and 34—36	...	...	...	×			
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24	Terebratella Menardi (*Lam.*), Dav. C. M., pl. iii, fig. 42, and Sup., pl. viii, fig. 14	...	...	...	×			
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25	— trifida (*Meÿer*), Sup., pl. viii, figs. 15—17	...	...	...	...	...	...	×
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30	— — *var.* elongata (*Dav.*), Meÿer, Geol. Mag., vol. i, pl. xi, figs. 26, 27, 1864	...	...	...	× ?	...	...	×
31	— Martiniana (*d'Orb.*), Dav. C. M., pl. ii, fig. 26	...	...	...	...	...	...	×
31	— gracilis (*Schloth.*), Dav. C. M., tab. ii, figs. 13—15 (not 16 and 17)	×						
32	— rigida (*Sow.*), Dav. C. M., pl. ii, figs. 16, 17	...	×	...	×	×	× ?	
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Supplement page.	Genera, species, and reference to plates.	Norwich or Upper Chalk.	Lower Chalk.	Chalk Marl.	Upper Greensand.	Red Chalk, Hunstanton.	Gault.	Neocomian, Lower Greensand.
32	Terebratulina arcuata (*A. Roemer*), Dav. C. M., pl. iv, fig. 14 ; Sup. pl. ii, fig. 16	...	...	...	×			
33	Terebratula squamosa (*Mantell*), Dav. C. M., pl. v, figs. 5—11 ; pl. ii, fig. 15	...	...	×	×			
33	— capillata (*d'Archiac*), Dav. C. M., pl. v, fig. 12 ; Sup., pl. vii, fig. 2	...	...	...	...	× ?	...	×
33	— biplicata (*Sow.*), Dav. C. M., pl. vi, figs. 1—42 only ; Sup., pl. v, figs. 1, 2	...	...	?	×	×	×	
35	— sella (*Sow.*), Dav. C. M., pl. vii, figs. 4—10	...	...	...	...	...	?	×
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37	— sulcifera (*Morris*), Dav. C. M., p. 64, pl. vii, figs. 17—20	...	×					
37	— prælonga (*Sow.*), Dav. C. M., pl. vii, figs. 1, 2 ; Sup., pl. iii, p. 12, 13	...	...	...	...	...	...	×
37	— microtrema (*Walker*), Sup., pl. v, figs. 18—21	...	...	...	...	...	...	×
38	— Lankesteri (*Walker*), Sup., pl. iii, figs. 9—11	...	...	...	...	...	...	×
39	— abrupta (*Tate*), Sup., pl. ii, fig. 17	×						
40	— depressa (*Lamarck*), Dav. C. M., pl. ix, figs. 9—24 ; Sup., pl. iv, figs, 1 and 3, 4	..	...	...	...	...	...	×
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42	— Robertoni (*d'Archiac*) ? Dav. C. M., pl. ix, fig. 25, and Sup., pl. v, fig. 26	...	...	...	...	...	...	×
42	— Moutoniana (*d'Arch.*), Dav., Sup., pl. iv, figs. 11—13	...	...	...	...	...	...	×
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Supplement page.	Genera, species, and reference to plates.	Norwich or Upper Chalk.	Lower Chalk.	Chalk Marl.	Upper Greensand.	Red Chalk, Hunstanton.	Gault.	Neocomian, Lower Greensand.
57	Rhynchonella plicatilis (*Sow.*), Dav. C. M., pl. x, figs. 37—42	×	×					
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—	— *var.* Woodwardi (*Dav.*), C. M., pl. x, figs. 43—46	×						
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57	— — *var.* robusta (*Tate*), Sup., pl. vii, fig. 18	...	...	...	×			
—	— Martini (*Mantell*), Dav. C. M., pl. xii, figs. 15, 16	...	×	×				
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59	— Schloenbachi (*Dav.*), C. M., pl. xii, figs. 28—30	...	...	...	×			
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61	— dimidiata (*Sow.*), Dav. C. M., pl. xi, figs. 1—5; pl. xii, fig. 25	...	...	...	×			
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66	— nuciformis (*Sow.*), Dav. C. M., pl. xi, figs. 23—27 (not pl. ii, fig. 27)	...	...	...	...	...	...	×
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67	— Gibbsiana (*Sow.*), Dav. C. M., pl. xii, figs. 11, 12	...	...	...	...	...	...	×
67	— parvirostris (*Sow.*), Dav. C. M., pl. xii, figs. 13, 14; Sup., pl. viii, fig. 29	...	...	...	...	...	...	×
68	— Cantabrigensis (*Dav.*), Sup., pl. viii, fig. 30	...	...	...	...	...	...	×
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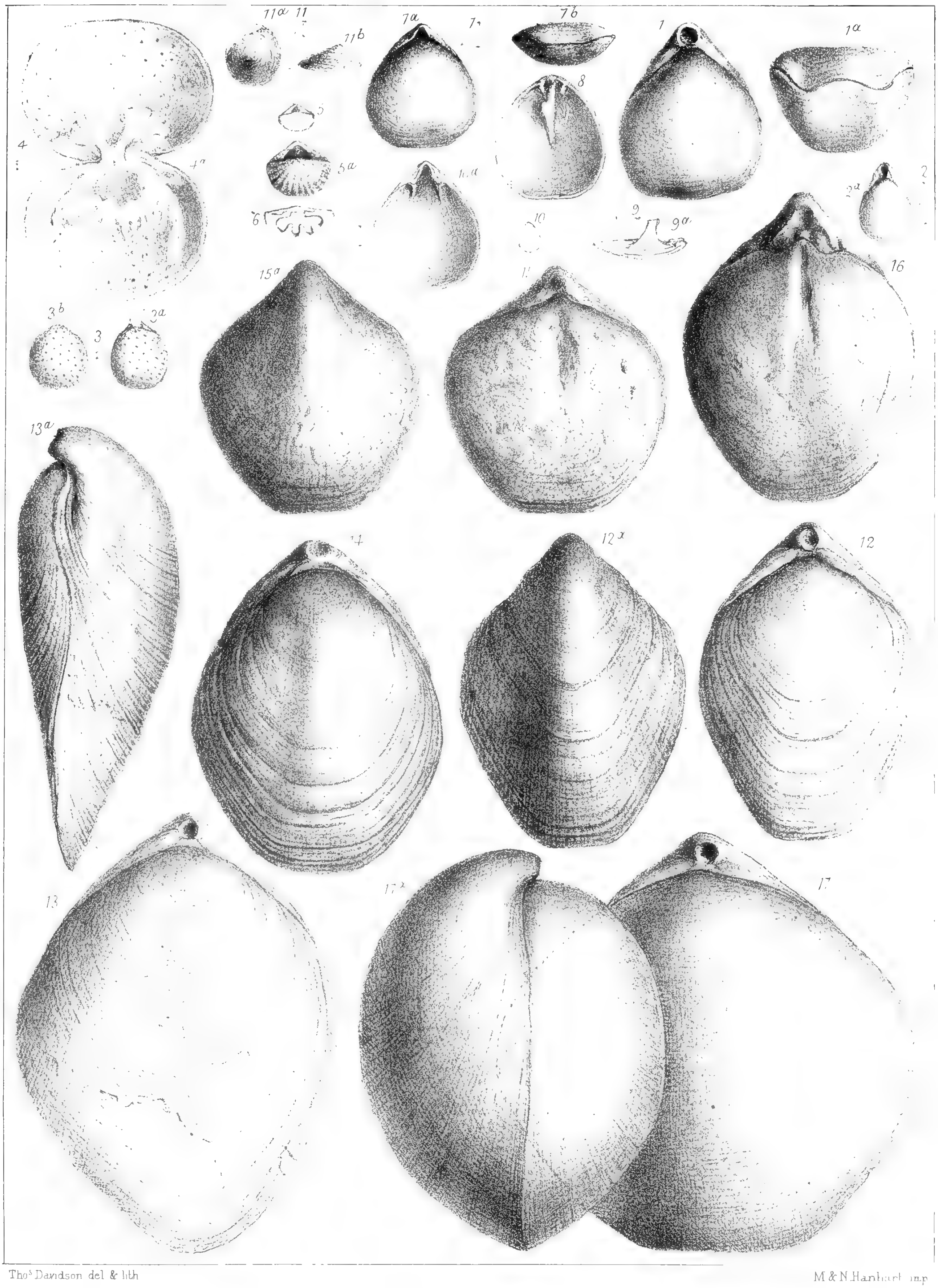
SUPPLEMENT, PLATE I.

RECENT.

Fig.	
1.	*Waldheimia septigera*, Lovén, sp. Chops of the Channel. (P. 4.)
2.	*Terebratella Spitzbergensis,* Dav. Thirty miles north-north-west of Unst. (P. 4.)
3, 4.	*Gwynia capsula,* Jeffreys, sp. Belfast Bay. 4 *a*. Enlarged sketch of interior of both valves. (P. 5.)
5, 6.	*Argiope decollata,* Chemnitz, sp. (After Jeffreys). Two miles east of Guernsey. (P. 7.)
7—10.	*Astretia gnomon,* Jeffreys. Off the north coast of Ireland. 7 *a, b*. Shell restored and magnified. 8. Incomplete interior of dorsal valve, enlarged. 9 *a*. Profile view of the same. 10 *a*. Interior of ventral valve, also enlarged. (P. 7.)
11.	*Discina Atlantica,* King. West coast of Ireland. 11 *a, b*. Enlarged. (P. 2.)

DRIFT.

12, 13. (14, 15, 16 ?).	*Terebratula ovoides,* Sow. 12. Feltwell, Norfolk. 13. = *T. rex,* after Lankester. Thorpe, Suffolk. 14 ? Rosslyn Pit, near Ely. Collection of Mr. Walker. 15, 16. Internal casts, attributed to *T. ovoides* by Mr. Lankester. Upware, Cambridgeshire. (P. 9.)
17. *Terebratula* ?	Drift, North Peckenham, Suffolk. Collection of the late Mr. C. B. Rose. (P. 11.)



Thos Davidson del & lith M & N Hanhart imp

SUPPLEMENT, PLATE II.

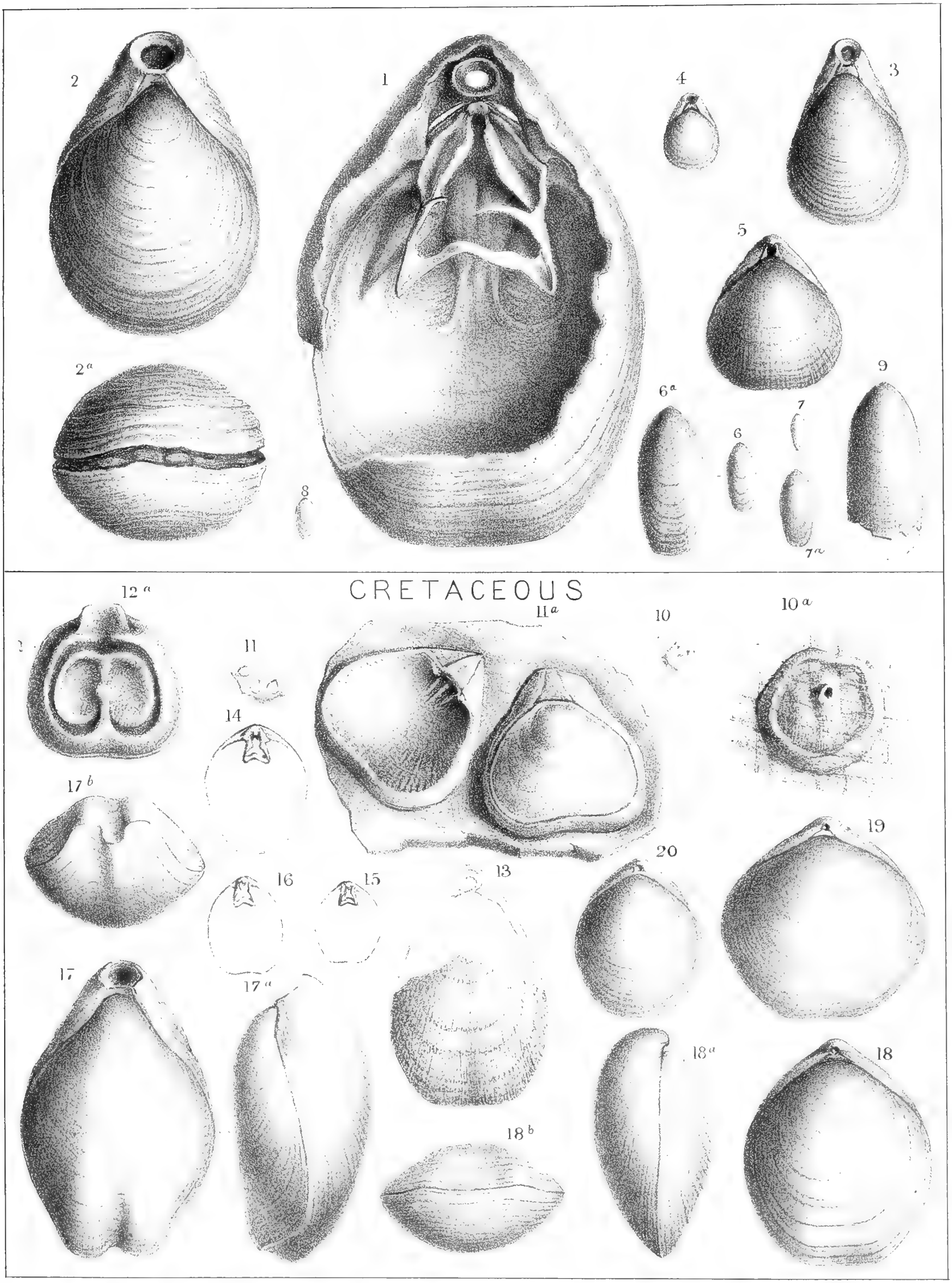
TERTIARY.

Fig.		
1.	*Terebratula grandis,* Blum.	Showing the loop complete. Coralline Crag, Ramsholt. British Museum. (P. 15.)
2—4.	,, ,, var.	Red Crag, Waldringfield, near Woodbridge.
5.	*Rhynchonella psittacea,* Chemnitz.	Red Crag, Sutton. (P. 16.)
6—8.	*Lingula tenuis,* Sow.	6, 6 *a*. Enlarged. London Clay (Bognor series), docks at Portsmouth. 7, 7 *a*. Enlarged. London Clay, Highgate Archway. 8. From the upper part of London Clay, Sydenham. Collection of Mr. Meÿer. (P. 12.)
9.	,, *Dumortieri,* Nyst.	From the 'Crag Gris' of Antwerp, to show the large size the species sometimes attains to. (P. 13.)

CRETACEOUS.

10.	*Crania* sp.?	Fig. 10 *a*. Enlarged. Red Chalk, Hunstanton. Collection of Rev. T. Wiltshire. (P. 22.)
11, 12.	*Thecidium Faringdonense,* Meÿer, M.S.	11 *a*. Enlarged. 'Sponge Gravel,' Lower Greensand, Faringdon. Collection of Mr. Walker. 12. Interior of dorsal valve, enlarged. Id. (P. 23.)
13.	*Terebratulina striata,* var. *Defrancii.*	Upper Chalk, Kilcorig, Lisburn, Ireland. Collection of Mr. Ralph Tate. (P. 30.)
14.	*Terebratula ovata,* Sow.	Showing loop. Chloritic Marl, Dunscombe. Collection of Mr. Meÿer. (P. 32.)
15.	,, *squamosa,* Mantell.	Showing loop. Chloritic Marl, Pinney Cliff, near Lyme Regis. Collection of Mr. Meÿer. (P. 33.)
16.	,, *arcuata,* Roemer = *rugulosa,* Morris.	Showing loop. Chloritic Marl, Pinney Cliff, near Lyme Regis. Collection of Mr. Meÿer. (P. 32.)
17.	,, *abrupta,* Tate.	Upper Chalk, Lisburn, County Antrim, Ireland. Collection of Mr. R. Tate. (P. 39.)
18—20.	,, *semiglobosa?* var. *Hibernica.*	Hibernian Greensand or Calcareo-chloritic Sandstone, near Belfast, Ireland. (P. 45.)

TERTIARY.



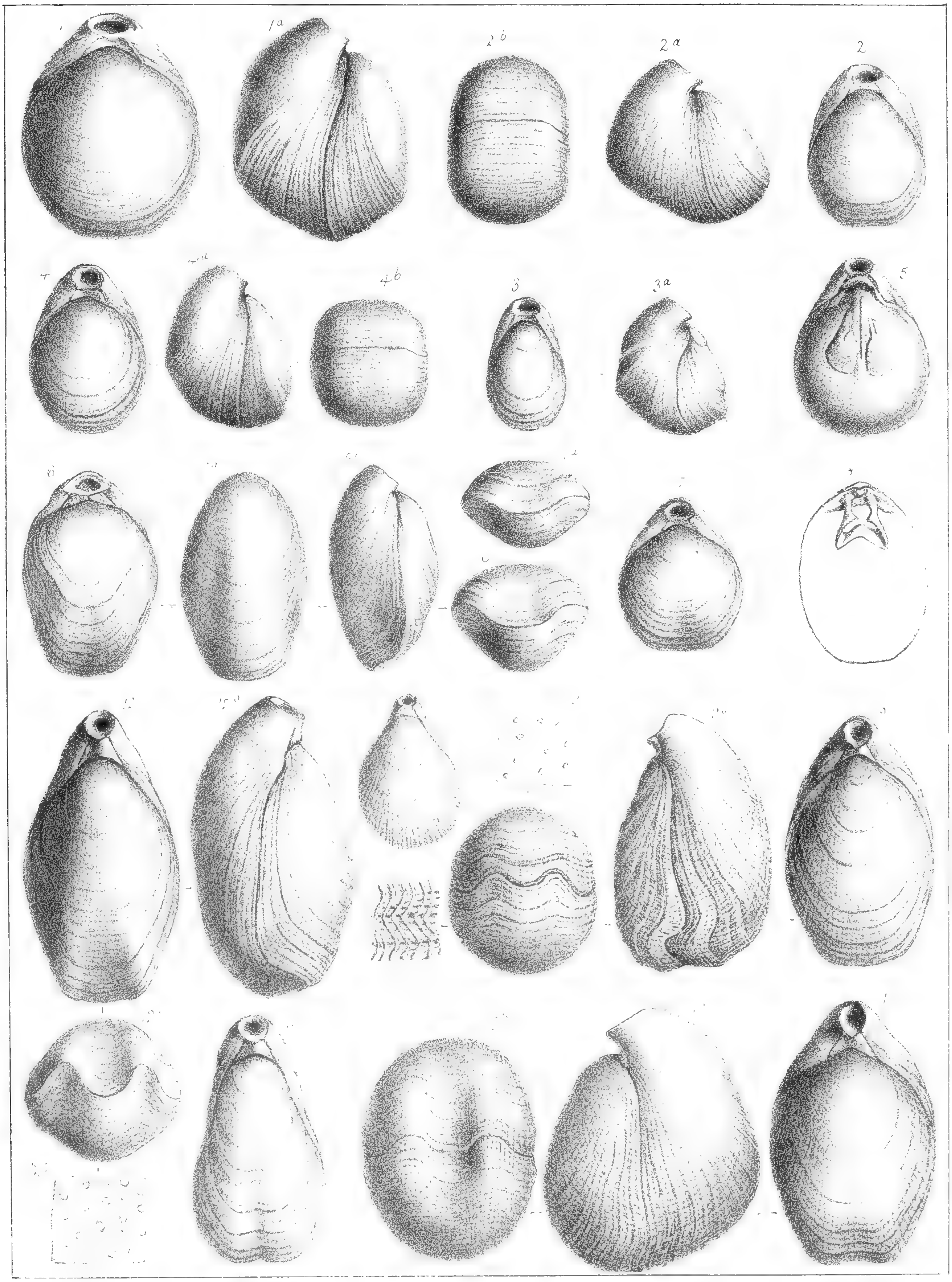
Thos Davidson del & lith

M&N Hanhart imp

SUPPLEMENT, PLATE III.

CRETACEOUS.

Fig.		
1—5.	*Terebratula Dallasii*, Walker.	Different forms. 1, 2. Lower Greensand, Upware. Woodwardian Museum, Cambridge. 3. Id. 4. Lower Greensand Conglomerate, Potton. Collection of Mr. Walker. 5. Internal Cast. Upware. (P. 45.)
6—8.	,, *Meyeri*, Walker.	Lower Greensand, Upware, near Cambridge. 8. Loop. (P. 44.)
9—11.	,, *Lankesteri*, Walker.	Lower Greensand, Upware. 10. A very large example. Woodwardian Museum, Cambridge. 11. A young shell. Collection of Mr. Walker. (P. 38.)
12, 13.	,, *prælonga*, Sow.	Lower Greensand, Upware. 12. A very large example, in the Collection of Mr. Walker. (P. 37.)



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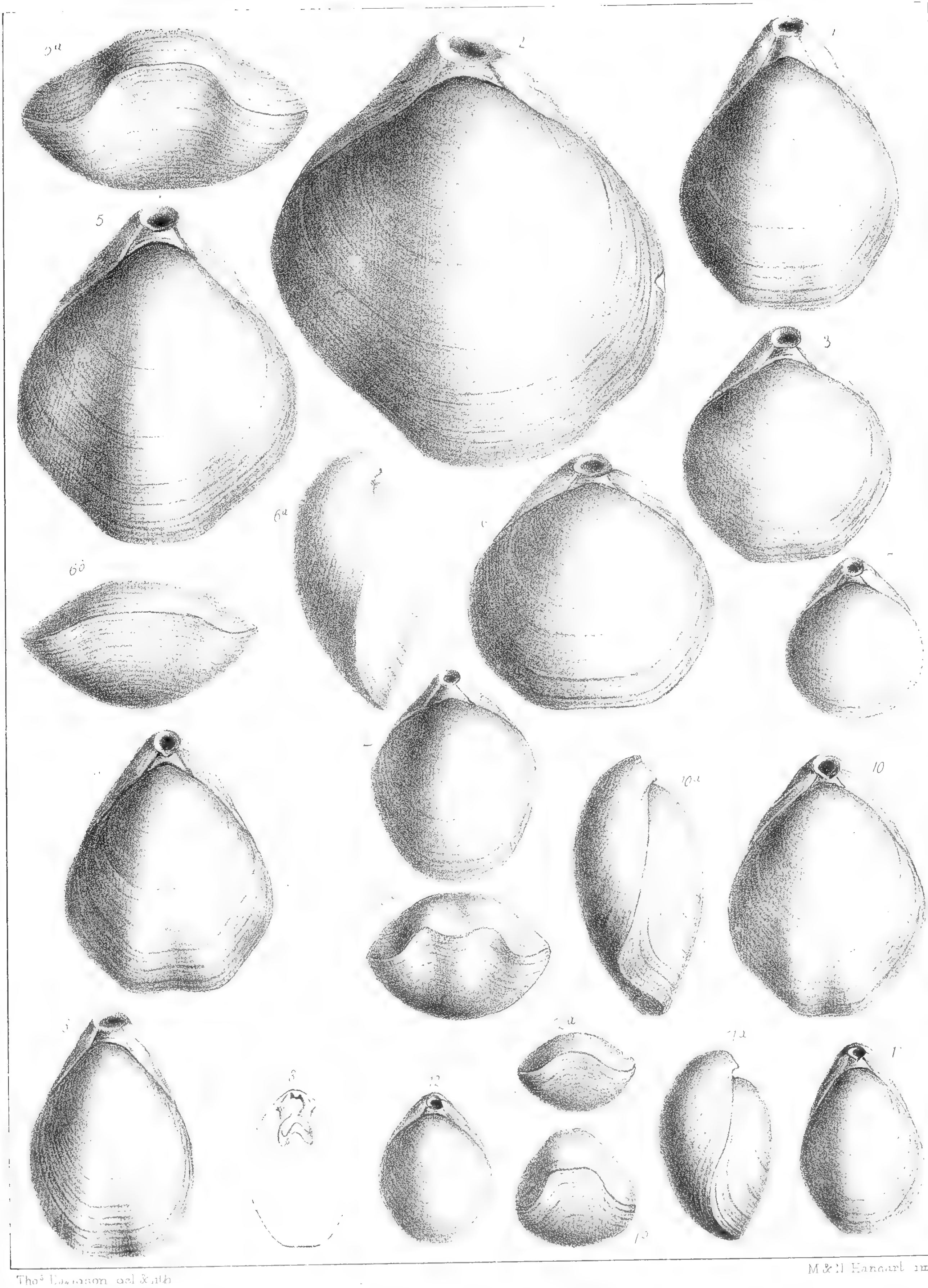
SUPPLEMENT, PLATE IV.

CRETACEOUS.

FIG.	
1—4.	*Terebratula depressa,* Lamarck. 1, 2. Lower Greensand, Upware, Cambridgeshire. 1. Typical form of species. 2. Merging into var. *uniplicata.* Woodwardian Museum, Cambridge. 3. Lower Greensand (Middle Neocomian), Acre House, Lincolnshire. Woodwardian Museum, Cambridge. 4. Lower Greensand, Isle of Wight. (P. 40.)
5.	,, ,, var. *uniplicata,* Walker. Lower Greensand, Upware. Collection of Mr. Walker.
6, 7.	,, ,, var. *cyrta,* Walker. Lower Greensand, Upware.
8—10.	,, ,, var. *Cantabrigensis,* Walker. Lower Greensand, Upware.
11—13.	,, *Moutoniana,* D'Orb. Lower Greensand, Upware. 13. Loop. (P. 42.)



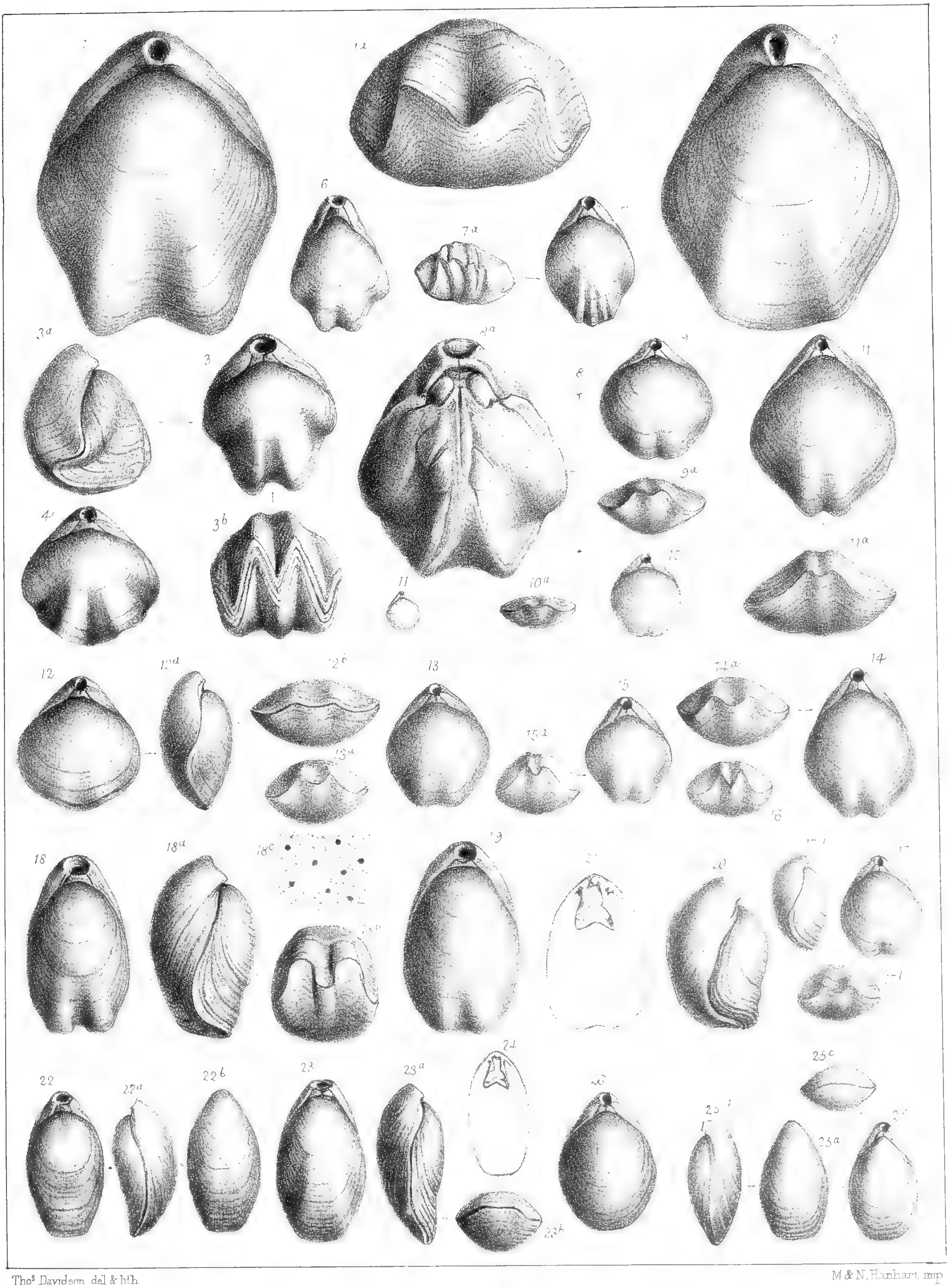
Thos Davidson del & lith

M & N Hanhart imp

SUPPLEMENT, PLATE V.

CRETACEOUS.

Fig.		
1, 2.	*Terebratula biplicata*, Sow.	Very large examples, from Red Chalk of Hunstanton. 1. Collection of the Rev. T. Wiltshire. (P. 33.)
3—10.	,, *sella*, var. *Upwarensis*, Walker.	Different ages and forms. Lower Greensand, Upware, Cambridgeshire. 8. Internal cast. (P. 35.)
11, 11 *a*.	,, ,, var.	Lower Greensand (Middle Neocomian), Acre House, Tealby, Lincolnshire. Woodwardian Museum, Cambridge. (P. 36.)
12—16.	,, ,, var.	From the upper beds of the Lower Greensand, Shanklin. Collection of Mr. Meÿer. (P. 36.)
17.	,, *phaseolina*, Lamarck ?	Upper Greensand, Niton, Isle of Wight. Collection of Mr. Meÿer. (P. 36.)
18—21.	,, *microtrema*, Walker.	Lower Greensand, Upware. 21. Loop. (P. 37.)
22—24.	,, *extensa*, Meÿer.	22. Pebble bed, Lower Greensand, Tewsley, near Godalming (after Meÿer). 23, 24. Upper Greensand, Upware. (P. 43.)
25.	,, *Boubei ?* D'Archiac.	Pebble bed, Lower Greensand, Tewsley, near Godalming (after Meÿer).
26.	,, *Robertoni ?* D'Archiac.	Pebble bed, Lower Greensand, Guildford. Collection of Mr. Meÿer. (P. 42.)



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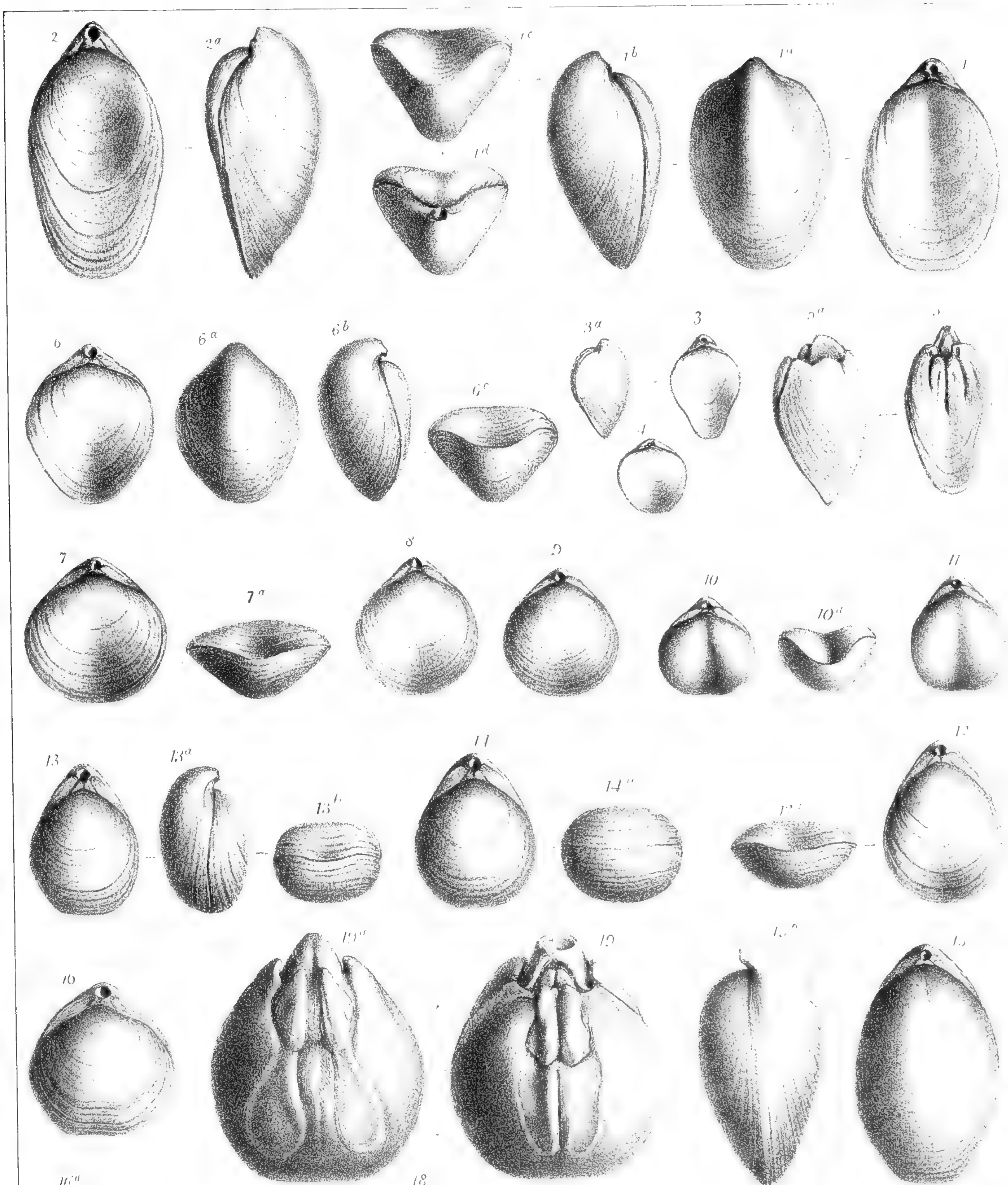
SUPPLEMENT, PLATE VI.

CRETACEOUS.

Fig.		
1—5.	*Waldheimia Woodwardi,* Walker.	Lower Greensand, Upware, Cambridgeshire. 5. Internal cast. (P. 52.)
6—9.	,, *Walkeri,* Dav.	Ironstone beds, Middle Neocomian, Acre House, Tealby, Lincolnshire. 6. Museum of School of Mines. 7, 8. Woodwardian Museum, Cambridge. (P. 54.)
10, 11.	,, *hippopus?* Roemer, var. *Tilbyensis.*	Middle Neocomian, Tealby, Lincolnshire. Museum of School of Mines. (P. 53.)
12—14.	,, *faba,* D'Orbigny, not Sow. = *T. longa,* Roemer.	12. Speeton Clay, Lower Greensand, Knapton, Yorkshire. From the Collection of Mr. Bean. 13, 14. From Middle Neocomian, Tealby, Lincolnshire. 1. Museum of School of Mines. 14. Woodwardian Museum, Cambridge. (P. 55.)
15.	,, *celtica,* Morris.	A large example. Lower Greensand, Shanklin, Isle of Wight. Collection of Mr. Meÿer. (P. 47.)
16—19.	,, *tamarindus,* Sow., var. *magna,* Walker.	Lower Greensand, Upware, Cambridgeshire. 19, 19 *a.* Internal cast. 18. Loop, after a figure by Mr. Meÿer. (P. 49.)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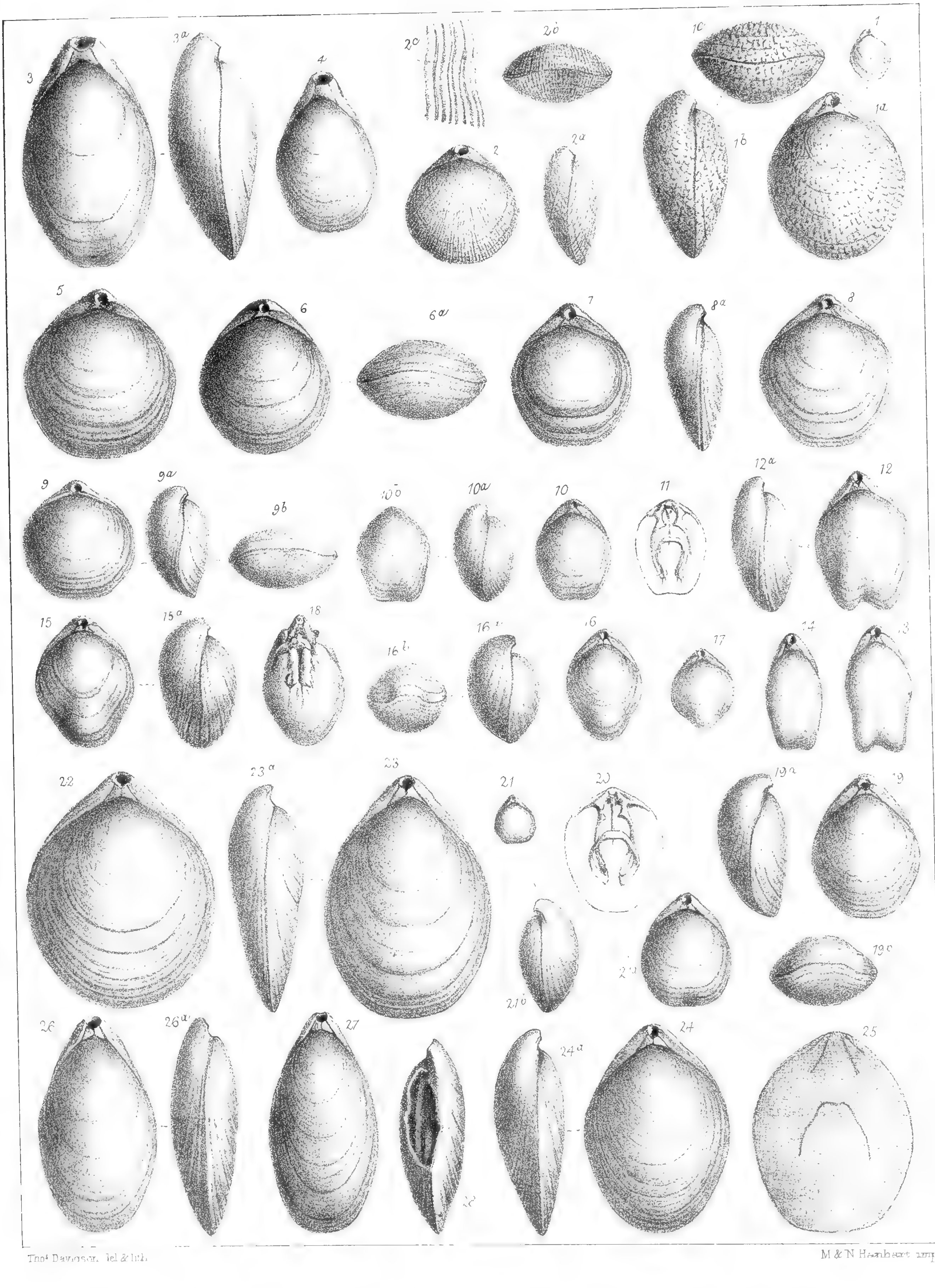
SUPPLEMENT, PLATE VII.

CRETACEOUS.

Fig.		
1.	*Terebratula*	*ovata*, Sow.? Upper part of Lower Greensand, Blackdown. Woodwardian Museum, Cambridge. 1 *a, b, c.* Enlarged. (P. 32.)
2.	,,	*capillata*, D'Archiac. Lower Greensand, Upware. Woodwardian Museum, Cambridge. (P. 33.)
3—4.	,,	*Seeleyi*, Walker. Lower Greensand, Upware. Collection of Mr. Walker. (P. 43.)
5—9.	*Waldheimia*	*tamarindus*, Sow.? var. *Tilbyensis*. From Lower Greensand or Middle Neocomian of Acre House, near Tealby, Lincolnshire. Woodwardian Museum, Cambridge, and Museum of School of Mines. (P. 49.)
10—14.	,,	*pseudo-jurensis*, Ley. 10, 11. From Lower Greensand or Folkstone beds. Collection of Mr. Meÿer. 12—14. Lower Greensand, Upware. (P. 48.)
15—18.	,,	*Juddii*, Walker = *W. rhomboidea*, Walker. Lower Greensand, Upware. 18. Internal cast. 15. Woodwardian Museum, Cambridge. 16. Collection of Mr. Walker. (P. 50.)
19, 20.	,,	*Morrisi*, Meÿer = *T. Moutoniana*, Meÿer and Lankester, not of d'Orb. Lower Greensand, Shanklin, Isle of Wight. Collection of Mr. Meÿer. (P. 47.)
21.	,, ?	*Hibernica*, R. Tate. Chloritic Sandstone, Colin Glen, Ireland. (P. 50.)
22—28.	,,	*Wanklyni*, Walker. Lower Greensand, Upware. 22—25. Var. *elliptica*. 26—28. Var. *angusta*, Walker = *T. mutabilis*, Walker, not of Oppel. 22. Collection of Mr. Walker. 26. Woodwardian Museum, Cambridge. 25 and 28 show loop. (P. 51.)



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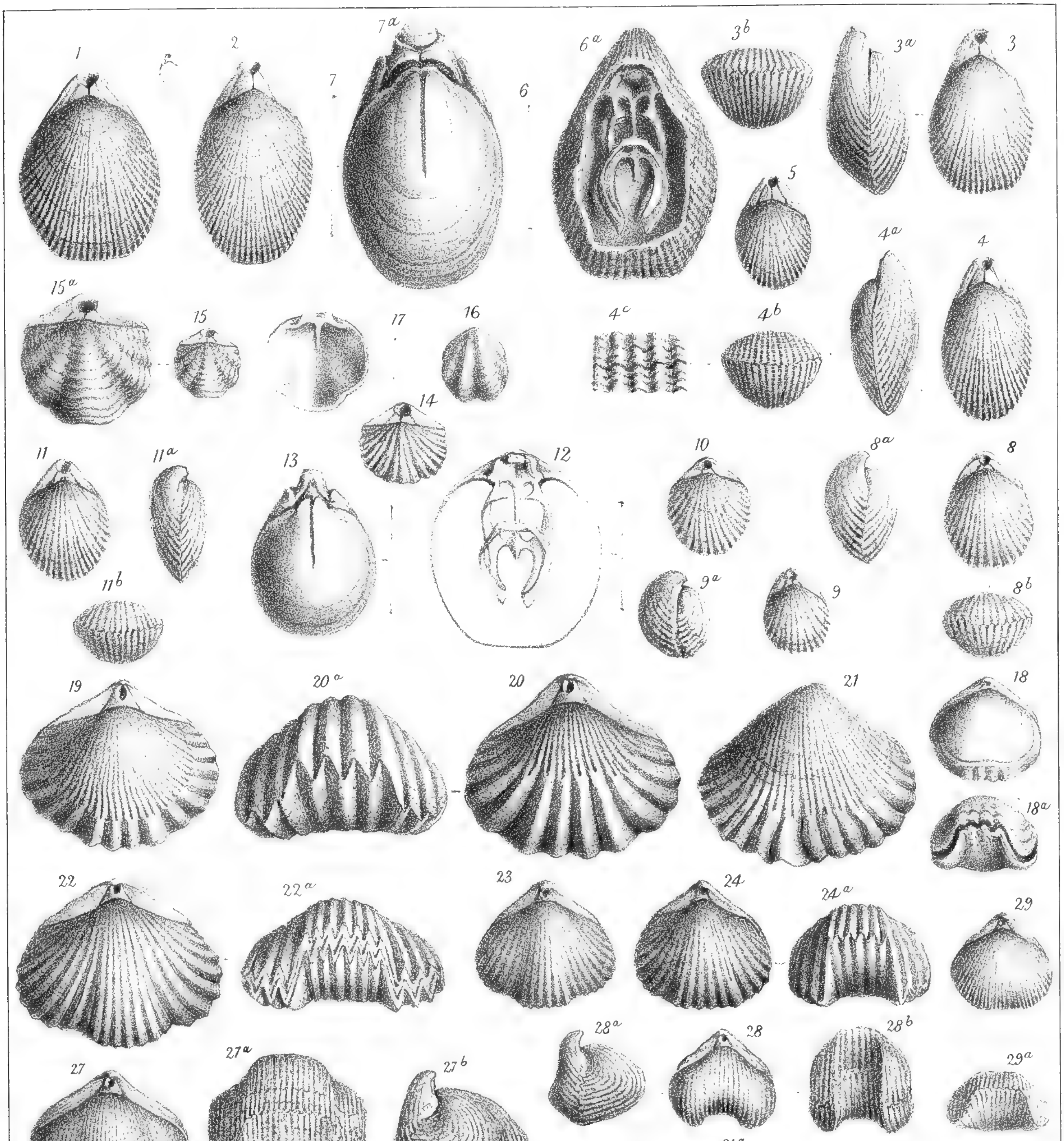
M & N Hanhart imp.

SUPPLEMENT, PLATE VIII.

CRETACEOUS.

Fig.		
1—7.	*Terebratella Davidsoni*, Walker.	Lower Greensand, Upware. 6. Interior, showing loop. Collection of Mr. Meÿer. 7. Internal cast. (P. 27.)
8—13.	,, *Fittoni*, Meÿer.	Lower Greensand, Upware. 12. Interior of dorsal valve, showing loop, enlarged. Collection of Mr. Meÿer. 13. Internal cast, enlarged. (P. 26.)
14.	,, *Menardi*, Lam.	Upper Greensand, Chardstock. (P. 24.)
15—17.	,, *trifida*, Meÿer.	Bargate Stone, Lower Greensand, Godalming. Collection of Mr. Meÿer. 15 *a*. Enlarged. (P. 25.)
18.	*Rhynchonella limbata*, Schloth., var. *robusta*, Tate.	Upper Greensand, Woodburn, Ireland. (P. 57.)
19—21.	,, *antidichotoma*, Buvignier.	Lower Greensand, Upware. 19. Collection of Mr. Walker. 20. Woodwardian Museum, Cambridge. (P. 65.)
22, 23.	,, *multiformis*, Roemer.	Middle Neocomian, Tealby. Woodwardian Museum, Cambridge. (P. 63.)
24, 25.	,, *depressa*, Sow.	Lower Greensand, Upware. (P. 58.)
26.	,, ?	Lower Greensand, Blackdown. Woodwardian Museum, Cambridge.
27, 28.	,, *Upwarensis*, Dav.	Lower Greensand, Upware, Cambridge. Collection of Mr. Walker. (P. 66.)
29.	,, *parvirostris*, Sow.	Lower Greensand, Redcliffe, Isle of Wight. Collection of Mr. Meÿer. (P. 67.)
30.	,, *Cantabrigensis*, Dav.	Lower Greensand, Upware. (P. 68.)
31.	,, *Wiestii*, Quenstedt.	Chloritic Marl, Beer Head. Collection of Mr. Meÿer. (P. 66.)
32.	,, *Speetonensis*, Dav.	Speeton Clay, Middle Neocomian, Speeton. Woodwardian Museum, Cambridge. (P. 69.)
33, 34.	,, *Walkeri*, Dav.	Middle Neocomian, Tealby. 33. Woodwardian Museum, Cambridge. 24. Museum of School of Mines. (P. 68.)



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THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1873.

LONDON:
MDCCCLXXIV.

SUPPLEMENT

TO THE

CRAG MOLLUSCA,

COMPRISING

TESTACEA FROM THE UPPER TERTIARIES OF THE EAST OF ENGLAND.

BY

SEARLES V. WOOD, F.G.S.

PART II.

BIVALVES.

PAGES 99–231; PLATES VIII—XI, AND ADDENDUM PLATE.

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PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1874.

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	PAGES	PLATES		
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Volume II.—Bivalves..................	1—150	I—XII	1850	June, 1851.
,, ...	151—216	XIII—XX	1853	December, 1853.
,, ...	217—342	XXI—XXXI	1855	February, 1857.
,, (note)	1 and 2	...	1858	March, 1861.
Volume III.—Supplement, Univalves. With the Geology of the Crag District	i—xxxi, 1—99	Map of Crag District, I—VII	1871	June, 1872.
Supplement, Bivalves	99—231	VIII—XI and Addendum Plate	1873	February, 1874.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCLXI.

A MONOGRAPH

OF THE

CRAG MOLLUSCA,

WITH

DESCRIPTION OF SHELLS

FROM THE

UPPER TERTIARIES OF THE BRITISH ISLES.

BY

SEARLES V. WOOD, F.G.S.

VOL. II.

BIVALVES.

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THE

PALÆONTOGRAPHICAL SOCIETY.

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SUPPLEMENT

TO THE

MONOGRAPH OF THE CRAG MOLLUSCA,

WITH

DESCRIPTIONS OF SHELLS

FROM THE

UPPER TERTIARIES OF THE EAST OF ENGLAND.

BY

SEARLES V. WOOD, F.G.S.

VOL. III.

UNIVALVES AND BIVALVES.

WITH

AN INTRODUCTORY OUTLINE OF THE GEOLOGY OF THE SAME DISTRICT, AND MAP.

BY

S. V. WOOD, JUN., F.G.S., AND F. W. HARMER, F.G.S.

LONDON:

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1872—1874.

PRINTED BY
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Charlesworth. If this be so the specimens hitherto spoken of under this name, and which were found on the beach at Felixstow were probably derived from the Cor. Crag.

I will figure this fragment (unless a better specimen in the meantime should be found) in the concluding part of this 'Supplement.'

PTEROPODA.

CLEODORA INFUNDIBULUM, *S. Wood.* Crag Moll., vol. i, p. 191, Tab. XXI, fig. 14.

I have obtained only one specimen of this little Pteropod since it was described as above, and this, like my others, is imperfect. It was from the Cor. Crag of Sutton.

At p. 120 of vol. v 'Brit. Conch.,' it is said that my Crag shell is probably *Clio caudata* of Linné, *Cleodora compressa* of Souleyet. This, however, wants confirmation. Of the recent shell it is said that "the apex is globular." I have not heard of *C. infundibulum* having been found anywhere but in the Cor. Crag of Sutton.

It may possibly be the shell so called figured in Barbut's 'Worms,' Tab. VII, fig. 7, but I have not been able to satisfy myself on the point.

BIVALVIA.[1]

ANOMIA EPHIPPIUM, *Linné*. Crag Moll., vol ii, p. 8, Tab. I, fig. 3.

Localities. Cor. Crag passim. Red Crag, Sutton. Fluvio-marine Crag, Bramerton. Chillesford bed, Aldeby and Bramerton. Middle Glacial, Hopton and Billockby. Upper Glacial, Bridlington (*Woodward*).

In the Cor. Crag young specimens are very abundant, as they are also in the Middle Glacial sands of Hopton and Billockby, and, unlike the general condition of the fossils of those sands, they are usually uninjured. This species occurs in the Fluvio-marine Crag of Bramerton, though rarely, but it is common in the Chillesford bed, where that bed is not in the Fluvio-marine condition, as at Aldeby and Bramerton; but I have not met with it where it is in the Fluvio-marine condition, as at Horstead, Burgh, or Coltishall, nor in the Lower Glacial sands. It is rare in the Red Crag.

ANOMIA EPHIPPIUM, var. ACULEATA, *Müller*. Crag Moll., vol. ii, p. 9, Tab. I, fig 2.

Localities. Cor. Crag, Sutton. Chillesford bed, Aldeby and Bramerton. Middle Glacial, Hopton.

Specimens of this shell have been sent to me by Messrs. Crowfoot and Dowson from Aldeby, and two young specimens have occurred at Hopton.

ANOMIA STRIATA, *Brocchi*. Crag Moll., vol. ii, p. 11, Tab. II, fig. 3.

Localities. Cor. Crag passim. Red Crag, Sutton and Butley. Chillesford bed, Aldeby. Middle Glacial, Hopton.

A specimen of this shell was sent to me from Aldeby by Messrs. Crowfoot and Dowson, and a solitary specimen was obtained by me from the Red Crag of Sutton,

[1] A system now prevails of restoring to a species the earliest name given to it from the date of Linné's 12th edition of his 'Syst. Nat.,' however long such name may have been in disuse. This is only fair and just, and I have endeavoured to conform to such a rule; but why this custom should be adopted with respect to species, yet disregarded with respect to the more comprehensive divisions of the Animal Kingdom, I am at a loss to understand, and I still see no reason why Linné's term of BIVALVIA should be superseded.

one from the Lower Glacial sand of Belaugh, and a fragment from the Middle Glacial sand of Hopton, and these are all the instances that have occurred to my knowledge. It is by no means uncommon in the Cor. Crag, where specimens have a diameter of two inches.

ANOMIA PATELLIFORMIS, *Linné*. Crag Moll., vol. ii, p. 10, Tab. I, fig. 4.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Bramerton. Chillesford bed, Sudbourn Church Walks, Aldeby and Bramerton.

This species has been sent to me by Mr. Reeve from both beds at Bramerton, and by Messrs. Crowfoot and Dowson from Aldeby. Mr. Bell ('Ann. and Mag. Nat. Hist.,' 1870) gives it from Sudbourn. In the other localities I have obtained it myself.

At p. 323, Appendix to 'Crag. Moll.,' Tab. XXXI, fig. 24, a Cor. Crag fossil was figured erroneously under the name of *Aplysia ?* This I have since found to be the more solid portion of the lower or adherent valve of some species of *Anomia*, probably *A. ephippium*.

OSTREA EDULIS, *Linné*. Crag. Moll., vol. ii, p. 13, Tab. II, fig. 1.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Bramerton and Thorpe. Post Glacial, March, Kelsea Hill, Hunstanton, and Nar Valley.

In 'Quart. Journ. Geol. Soc.,' vol. xxvi, p. 94, a list of shells from the Middle Glacial sands is given on my authority, and in it this species is given from Stevenage, in Herts. Since then I have doubted whether the specimens upon the strength of which the name was inserted may not be those of *Gryphæa dilatata*, and I have therefore omitted the species as a Middle Glacial shell. So far as the testaceous remains are a guide, I cannot in many instances distinguish between the forms of the secondary *Gryphæa* and those of the recent *Ostrea*. The species *O. edulis* is given in Dr. Woodward's list (in 'White's Directory') as occurring at Bramerton and Thorpe, but I have not seen it from thence, nor from any of the localities of the Chillesford bed. It is very profuse in the Post Glacial gravels of March, Kelsea Hill, and Hunstanton, as well as (according to Mr. Rose) in all the Nar Brickearth localities.

OSTREA COCHLEAR, *Poli*. Crag Moll. vol. ii, p. 14, Tab. II, fig. 1*c*, as *O. edulis*, var. *spectrum*.

Mr. Jeffreys, in his list accompanying Mr. Prestwich's Cor. Crag paper, and also Mr.

Bell ('Ann. and Mag. Nat. Hist.,' 1870) give *O. cochlear* as a Cor. Crag fossil, the former referring my var. *spectrum* to that species.

This probably may be so. I have therefore inserted it here as a species.

OSTREA PLICATULA, *Gmel.* Supplement, Tab. VIII, fig 10.

Locality. Cor. Crag, Sutton.

I have represented a specimen of the genus *Ostrea* obtained by myself which varies considerably from the normal condition of *O. edulis*, but it is difficult to determine the limitation of a species in this variable genus; however, if *O. cochlear* be entitled to that distinction, I think my present shell may have the same honour. It may possibly be *O. ungulata*, Nyst., but I have given to it the prior name by Gmelin. This is very variable, adhering sometimes by a very small part of the shell near the umbo, but I have specimens with similar rays in which the attachment of the lower valve had been effected by much the larger part of the surface. It resembles, and is probably the same as *O. cristata*, Born (tab. 7, fig. 3), which is plicated only near the margin.

OSTREA FLABELLULA, *Lamarck.*

Locality. Red Crag, Sutton?

Many years ago I noticed in the late Mr. Edward Acton's collection of shells from the nodule workings in the Red Crag near Woodbridge a specimen of this species; but I have been unable since his death to find where it has gone to, or I would have had it figured. It was mentioned in my paper on the extraneous fossils of the Red Crag ('Quart. Journ. Geol. Soc.,' vol. xv, p. 32), as probably introduced into the Red Crag from an older formation. I perceive that it is given as a species from Biot, which is classed among the Upper Tertiaries, so it is not clear but that it may have lived in the Cor. Crag sea. The lithological condition of the Red Crag specimen was, however, like that of *Rostellaria lucida* and others, regarded as derivative from older Tertiaries.

HINNITES CORTESYI, *De France.* Crag Moll., vol. ii, p. 19, Tab. III.

Localities. Cor. Crag, Ramsholt. Red Crag, Sutton, Trimley (*Bell*). Fluvio-marine Crag, Thorpe?

In the 'Ann. and Mag. Nat. Hist.,' September, 1870, this shell is given by Mr. Bell from the Red Crag of Trimley as *Hinnites giganteus*, and in the list to Mr. Prestwich's Cor. Crag paper ('Quart. Journ. Geol. Soc.,' vol. xxvii, p. 139), this name is also inserted for the Crag shell by Mr. Jeffreys, and it is given in the list by Dr. P. Carpenter

in his 'Brit. Assoc. Reports,' 1863. I have compared my Crag shell with recent specimens of *H. giganteus* in the British Museum, and I cannot agree with those opinions. M. Fischer has, in 'Journ. de Conch.,' vol. x, p. 205, referred the fossil to *Ostrea crispa*, Broc. ('Conch. foss. sub-Apen.,' vol. ii, p. 567), which may possibly be correct; but there is no figure given of that species by Brocchi, and I have therefore left the Crag shell as originally described.

I have myself also found a single valve in the Red Crag at Ramsholt, subsequent to the publication of the 'Crag Mollusca.' In the 'Geology of Norfolk' this species is given by S. Woodward as occurring rarely and in fragments at Thorpe, and the same thing is repeated in the Norwich Crag list of his son Dr. Woodward, but I have not seen it myself from the Fluvio-marine Crag.

PECTEN PRINCEPS, var. PSEUDO-PRINCEPS, *S. Wood.* Supplement, Tab. VIII, fig. 9.

Localities. Fluvio-marine Crag, Bramerton and Yarn Hill.

When describing *Pecten princeps* from the Coralline Crag ('Crag Moll.,' vol ii, p. 32, Tab. VI, fig. 1), I had occasion to refer to 'The Geology of Norfolk,' where at p. 44 that name is inserted, and against which is the letter *a* signifying abundant. I could not then obtain the sight of a specimen, or ascertain from any of my collecting friends at Norwich that they possessed this shell, and I thought possibly, from the general character of the Fauna of the Norwich Crag, that fragments of *P. Islandicus* might have been mistaken for it. Since then the late Dr. S. P. Woodward informed me that two specimens of *P. princeps* had been found near Norwich, and one of these (fig. 9 *b*), by the kindness of the Committee of the Norwich Museum, has been transmitted to me for examination. I have also had sent to me by Mr. Valentine Colchester (a son of my old friend Wm. Colchester, on whose land at Sutton I have obtained so many Crag species), a specimen which he found in association with *Voluta Lamberti* in the Fluvio-marine deposit at Yarn Hill, and this also I have had represented, as it is the opposite valve to the one found at Bramerton, while another specimen from the same place has been obtained by Mr. E. Cavell. These different specimens present very considerable variation from the typical Coralline Crag shell in the exterior ornament, so much so that I thought at first sight they must be distinct; my specimens of *princeps*, however, from the Cor. Crag differ in the number and size of the rays from the one figured in 'Min. Conch.,' tab. 545, which I presume to be correct, and these both differ essentially from the specimens now figured, more especially so from the one from Yarn Hill, which possesses nearly two hundred imbricated rays, while those of mine from the Cor. Crag have not half that number, even assuming an intermediate ray to be elevated into a primary one.

In the list in the Cor. Crag paper of Mr. Prestwich ('Quart. Journ. Geol. Soc.,' vol. xxvii, p. 140) Mr. Jeffreys gives this species as identical with *P. Islandicus,* a Clyde fossil ('Crag Moll.,' vol. ii, p, 40, Tab. V, fig. 1); but from that I dissent, as the difference between them is not inconsiderable, both in the sculpture and the form of the shell, as also in that of the ears.

Pecten princeps is not included by M. Nyst in his 'Descript. foss. de Belgique,' 1843; but in his later 'Listes des Fossiles des divers Étages' the species is given from both the Sables gris and from the Sables jaunâtres.

If the living *Islandicus* be, as is not improbable, the modified descendant, through the variety *pseudo-princeps,* of the older Pliocene form *princeps* of the Coralline and Belgian Crags, this again must have descended from some yet older form, and in this way the identification of species must go on indefinitely, unless such a line as seems necessary to me in this case be drawn.

PECTEN GERARDII, *Nyst.* Crag Moll., vol. ii, p. 24, Tab. V, fig. 5.

I know this shell only from the Cor. Crag. Mr. Jeffreys, in 'Brit. Conch.,' vol. ii, p. 68, speaking of *Pecten Testæ,* says that it resembles *P. Gerardii,* but in his list of Crag shells in the 'Quart. Journ.,' vol. xxvii, p. 140, *P. Gerardii* is referred to *P. Grœnlandicus,* Chemn. My own opinion is that the Crag shell is distinct from either of those existing species. As before stated ('Crag Moll.,' vol. ii, p. 25,) it more resembles an American fossil, but I believe it to be distinct from all, although the concluding remark which I have made in the case of *P. princeps* applies, *mutatis mutandis,* to the case of *P. Gerardii* and *P. Grœnlandicus.*

PECTEN VARIUS, *Linn.* Crag Moll., vol. ii, p. 41; Supplement, Tab. VIII, fig. 7.

Localities. Cor. Crag, Sutton? Middle Glacial, Hopton. Post Glacial, Nar Brick-earth (*Rose*).

The figure represents a small specimen found in the Cor. Crag, which I have provisionally referred as above, but it is a doubtful identification. Fragments of *varius* are not uncommon in the Middle Glacial sands of Hopton, but I do not know it from the Red or Fluvio-marine Crag, the Chillesford bed, or the Lower Glacial sands.

PECTEN NIVEUS? *Macgillivray.* Supplement, Tab. VIII, fig. 8.

PECTEN NIVEUS, *Macgill.* Edin. Phil. Journ., vol. xiii (1825), p. 166, pl. iii, fig. 1.

Locality. Cor. Crag, Sutton.

A single specimen, as above represented, is all that I have obtained or seen from the Upper Tertiaries of East Anglia which could be referred to this species. The artist has not made the figure sufficiently elliptical, and it possesses thirty-eight fine, delicate, closely set ribs. Since the engraving was made, however, I have obtained some intermediate forms, which induce me to doubt whether the present specimen, as well as that figured from the Coralline Crag as *varius*, may not be merely extreme modifications of *P. opercularis*.

PECTEN PUSIO, *Pennant*. Crag Moll., vol. ii, p. 33, Tab. VI, fig. 4.

Localities. Cor. Crag passim. Red Crag, Walton and Sutton. Middle Glacial, Hopton. Upper Glacial, Bridlington?

Some fragments of this species have occurred in the Middle Glacial sand, but they are rare. Its occurrence in the Fluvio-marine Crag seems doubtful, and I have not met with it from the Red Crag of Butley. There is a specimen in the British Museum presented by Dr. Murray with the locality of Bridlington attached to it, but it seems so unlike in colour and condition to the Bridlington fossils that its occurrence at that locality seems doubtful. Although very abundant in the Cor. Crag, I have never seen a specimen that showed marks of attachment by the exterior of the valve.

PECTEN OPERCULARIS, *Linn.*[1] Crag Moll., vol. ii, p. 35, Tab. VI, fig. 2; and Supplement, Tab. VIII, fig. 6.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Bramerton, Whitlingham, Thorpe, and Bulchamp. Chillesford bed, Aldeby and Chillesford. Middle Glacial, Billockby and Hopton.

The figure in Supplement represents a small shell from the Cor. Crag, which I think belongs to this species; it is about half an inch in diameter. It appears to be a distortion, and resembles the figure of *Ostrea arcuata*, Broc. ('Conch. foss. Subapen.,' tab. xiv, fig. 2), which is probably a distortion. This species is common in some of the localities of the Fluvio-marine Crag, and rare at others. It occurs, though not commonly, in some of the localities of the Chillesford bed, but I have not met with it from either Horstead, Burgh, or Coltishall, or with any trace of it in the Lower Glacial sands. In a fragmentary state it is very abundant in the Middle Glacial sands at Billockby, Clippesby, and Hopton.

[1] In the 'Ency. Method.,' pl. 314, fig. 1 *b*, is the figure of a shell with its animal inhabitant. This figure which seems very fanciful, was probably intended for *P. opercularis*, but the animal is represented as having a large protruding foot on one side with two projecting siphons on the other.

Pecten septemradiatus, *Chemn.* Crag Moll., vol. ii, p. 30, Tab. 4, fig. 2 (as *Pecten Danicus*).

Locality. Red Crag, Sutton and Foxhall.

This species was figured in the 'Crag Mollusca' from a Clyde bed specimen, and I mentioned (p. 31, note) that a worn specimen of my own from the Red Crag might belong to this species. Mr. A. Bell gives it from the Red Crag nodule pits at Foxhall ('Ann. and Mag. Nat. Hist.,' May, 1871). I therefore retain it as a fossil of the East Anglian Upper Tertiaries, but with doubt. I have adopted the above name in obedience to the rule of priority of nomenclature.

Pecten Westendorpianus, *Nyst.* Crag Moll., vol. ii, p. 323, Tab. XXXI, fig. 25 (as *P. maximus*, var. *larvatus*), Supplement, Tab. VIII, fig. 1.

Localities. Red Crag, Sutton and Waldringfield.

In the 'Crag Moll.' at the above reference this was thought by me to be possibly a variety of the common recent British shell, *P. maximus,* I having then only the flat valve, while M. Nyst's work, in which *Westendorpianus* is figured, showed only its convex valve ('Foss. Belg.,' pl. xviii, fig. 10). This did not justify me in referring my specimen to Nyst's species, and I was unwilling, as mentioned at the time, to call it a new species. Since this, however, M. Nyst, in the 'Bull. de l'Acad. Roy. des Sc. de Belgique,' has referred to my figure in the 'Crag. Moll.,' and observed that it represents the upper valve of his species *Westendorpianus.* I am, however, now able to introduce a figure of the lower or convex valve from a specimen which Mr. Canham has lately obtained from the nodule pits in the Red Crag at Waldringfield, which agrees with Nyst's figure. The rays are broader than those either of *maximus* or *Jacobæus,* and the depressions are deep and narrow, corresponding to the elevations of the flat valve (Tab. XXXI, fig. 25), which interlock when they are closed. Mr. Canham's specimen of the lower valve is the only one known to me, and the one I figured as the flat valve is, I believe, also unique.

Both of the specimens are probably derivative from some older Pliocene bed, though as yet no trace of the species has occurred in the Coralline Crag.

LIMA SUBAURICULATA, *Mont.* Crag Moll., vol. ii, p. 47, Tab. VII, figs. 3 *a* and *b*.

LIMA SUBAURICULATA, *Forbes* and *Hanley*. Brit. Moll., vol. ii, p. 263, tab. 53, figs. 4—5.
— ELLIPTICA, *Jeff.* Brit. Con., vol. ii, p. 81 ; and vol. v, pl. 25, fig. 2.

Localities. Cor. Crag, Sutton. Recent, Mediterranean, British, and Scandinavian Seas.

There is much confusion in reference to this species and the following (*elongata*), owing to the uncertainty as to which form Montague's figures were intended to represent and his description to attach, the two figures of Montague (one of the interior and the other of the exterior) being inconsistent with each other. Both were united by me in the 'Crag Mollusca' under the name *subauriculata*, the following species (*elongata*) being shown only as var. *elongata* (fig. 3 *c*). Mr. Jeffreys has, in 'Brit. Conch.,' given a new specific name (*elliptica*) to one of the two forms, which, he says, is that one from which Forbes and Hanley appear to have taken their description, and he has assigned Montague's name of *subauriculata* to the following species (*elongata*); and he adds that the species to which he thus assigns the name *elliptica* has not, in his belief, been found south of the Hebrides. Mr. Hanley, however, assures me that the specimen from which the figure and description in the 'Brit. Moll.' were taken came from the British Channel. As the other form has long been described under other names, it seems to be adding to complexity to introduce the name *elliptica* for either; and I have therefore retained Montague's name for the least elongated of the two forms which occur in the Crag, and in doing this I adhere to Forbes and Hanley's view of the matter.

LIMA ELONGATA, *Forbes.* Crag Moll., vol. ii, p. 47, Tab. VII, fig. 3 *c* (as *L. subauriculata*, var. *elongata*).

LIMA ELONGATA, *Forbes.* Rep. Ægean Invertebrata, Brit. Ass., 1843.
— SULCULUS, *Leach.* M.S. adopt. Loven. Ind. Moll. Scan., p. 32, 1846.
— SUBAURICULATA, *Forbes* and *Hanley.* Brit. Moll., vol. ii, p. 263 (not in figure).
— — *Jeffreys.* Brit. Conch., vol. ii, p. 82 ; vol. v, pl. 25, fig. 3.

Locality. Cor. Crag, Sutton. Recent, Arctic and British Seas, Mediterranean, Ægean, and Canaries.

This elongated form, figured by me as a variety only in 'Crag Moll.,' must, I presume, now be regarded as a distinct species, the only question being that of name. As it is clear

what was meant by Forbes in his 'Ægean Report' and by myself in the 'Crag Mollusca' (p. 48), there seems no reason why the name of Forbes, first published for the elongated form, should not be adopted as a specific one for it.

LIMA OVATA, *S. Wood.* Crag Moll., vol. ii, p. 48, Tab. VII, fig. 5.

This shell somewhat resembles *L. crassa*, of Forbes, of which two specimens from the Mediterranean were given by Forbes to me, but it is much more elongated and has less imbricated costæ than *crassa*. It appears to me also different from *L. Sarsii*. *Ostrea nivea*, Ren. (figured by Broc., tab. 14, fig. 14), was given by me as a synonym for *L. subauriculata*. Mr. Jeffreys, in his Cor. Crag list to Mr. Prestwich's paper, identifies it with *L. ovata*, but *O. nivea* is more than double the linear dimensions of *ovata*, and is, moreover, described by Philippi as "*lateribus compressa*," which is not the case with *ovata*. Philippi, moreover, adds to the description of *L. nivea* "*medio longitudinaliter sulcata*," which description, as well as the size, assimilates it to *subauriculata*. The Belgian Crag shell called *nivea* by Nyst is also described as "*lateribus compressis*."

LIMA EXILIS, *S. Wood.* Crag Moll., vol. ii, p. 43, Tab. VII, fig. 6.

Localities. Cor. Crag, Ramsholt, Sudbourn, and Sutton. Red Crag, Walton and Butley.

This shell is by Mr. Jeffreys in 'Quart. Jour.,' vol. xxvii, p. 139, referred to *L. inflata*, Lam., as also by Mr. Bell in 'Ann. and Mag. Nat. Hist.,' May, 1871. The authors of the 'Brit. Moll.' (vol. ii, p. 268) place the Crag shell *exilis* as a synonym to *L. hians*. I have re-examined my specimens, and find a difference between the Cor. Crag shell and the recent *inflata*, the former having a narrower hinge-line, and being less inflated than the latter. At the same time, however, it must be admitted that the specimens of *exilis* from the Red Crag approach rather nearer to the living *inflata*. In 'Crag Moll.,' vol. ii, p. 43, it was said of the shell that it somewhat resembled *L. inflata*, but is flatter and undeserving that name. Specimens of *inflata* from the Italian Tertiaries are much larger and more tumid.

LIMA HIANS, *Gmelin.* Crag Moll., vol. ii, p. 44, Tab. VII, fig. 2.

Localities. Cor. Crag, Ramsholt. Middle Glacial, Hopton?

Some hinges and other fragments of a species of *Lima* have occurred in the Middle Glacial sands. The coarseness of the striation on one of the fragments suggests their belonging to this species.

LIMA SQUAMOSA, *Lamarck*. Supplement Tab. X, fig. 1 *a*, *b*.

OSTREA LIMA, *Linn.* Syst. Nat., edit. 12, p. 1147 (pars).
— — *Poli.* Test. Utrius. 9, Sec., pl. xxviii, figs. 22—24.
LIMA SQUAMOSA, *Lam.* Hist. des An. sans Vert., t. vi, p. 156.
— — *G. Sowerby.* Genera *Lima*, fig. 2; Ency. Method., pl. 296, fig. 4.
— — *A. Bell.* Ann. and Mag. Nat. Hist., 1871.

Locality. Cor. Crag, near Orford.

The two specimens figured were obtained from a dealer in Orford, one of which has been kindly lent to me for figuring by Dr. Reed, of York, and the other by Mr. Cavell, of Saxmundham. These differ slightly from the recent species in having only eighteen to twenty rays, but in other respects there is sufficient resemblance to justify their reference to it.

In 'Crag Moll.,' vol. ii, p. 46, Tab. VII, fig. 4, and in the 'Ann. and Mag. Nat. Hist.' for 1839, p. 335, a small shell from the Cor. Crag of Sutton was figured and described by me under the name *L. plicatula*, and this (of which I have some other examples) may possibly be the young of *squamosa*. My little specimens, however, appear to differ from *squamosa* in being much less elongated and more ornamented between the rays, so that if they be young of *squamosa* the shell must alter materially in its growth. All these specimens are very rare, and until some of intermediate growth can be obtained the union of the two names under one cannot be adopted.

AVICULA PHALÆNOIDES, *S. Wood.* Crag Moll., vol. ii, p. 51; as *A. Tarentina*? Supplement, Tab. VIII, fig. 12. Addendum Plate, fig. 23.

Locality. Coralline Crag, Gedgrave.

In the 'Crag Mollusca' I introduced the name of *Avicula Tarentina*, from some fragments which I have had figured as above. A comparison of these with the recent *Tarentina* shows the Crag shell to have been possessed of a much thicker and broader and more solid hinge, resembling that of the Bordeaux fossil, *A. phalænacea*, Bast. As, however, my fragments, though apparently belonging to a larger shell than *Tarentina*, are those of shells possessing scarcely half the thickness or hinge dimensions of *phalænacea*, I have thought it best to give the Crag species provisionally the name of *phalænoides*.

Pinna pectinata? *Linn.* Crag Moll., vol. ii, p. 50, Tab. VIII, fig. 11.

Localities. Cor. Crag, Ramsholt and Sutton. Lower Glacial, Cromer Cliff?

The specimen figured as above referred to was found by myself in the Cor. Crag at Ramsholt, and, so far as its imperfect condition will permit of comparison, I still think it may retain the name previously given to it, but with the same doubt. Abundant fragments of a fibrous shell, that I think can only belong to some species of *Pinna*, were sent to me by Mr. Gunn from the Contorted Drift of the Cromer Cliff.

Pinna rudis? *Linn.* Supplement, Tab. IX, fig. 11.

Locality. Cor. Crag, Aldbro.

This specimen was obtained from the Polyzoan or Coralline Bank at Aldbro by the late Rev. T. Image, and placed in the Museum at Bury St. Edmunds. I am indebted to the kindness of Mr. H. Prigg, jun., of that town, and to the Museum Committee, for the use of it for the present figure. The specimen is embedded in the hardened matrix, and a portion of the shell at the smaller end has been removed.

Philippi says "Genus Pinnarum valde intricatum." That remark, perhaps, cannot be restricted to the genus *Pinna*; still, with the very imperfect materials afforded by the Cor. Crag, I think it desirable to give these specific names provisionally.

Fragments of *Pinna* are not uncommon both in the Cor. and Red Crags, but they are wholly indeterminable.

Mytilus edulis, *Linn.*, var. giganteus? Supplement, Tab. VIII, fig. 4.

Locality. Red Crag, Sutton.

The above represents a specimen of *Mytilus* in a very mutilated condition, but it indicates a magnitude for the shell when perfect of its having been six inches in length, and as this far exceeds the size of *M. edulis* of our own shores, I have thought it deserving of being figured. It came from the nodule pits in the Red Crag at Sutton, and may possibly be another species derived from some older formation. *M. edulis*, either whole or in fragments, is common to all the East Anglian beds except the Coralline Crag, in which only *M. hesperianus* occurs.

The variety *ungulatus* I have not seen from the Coralline Crag, but it is given from it by Mr. Bell in 'Proceedings of the Geologists' Association,' April, 1872.

Modiola discors, *Linn.* Crag Moll., vol. ii, p. 63, Tab. VIII, fig. 5.

Locality. Chillesford Bed, Chillesford.

In vol. ii of 'Crag Moll.' I assigned with doubt to this species a specimen obtained from the Chillesford Bed, but I have not seen it from any other East Anglian formation. In the list to Mr. Prestwich's 'Cor. Crag' paper this species is entered (*Modiolaria discors*) as a shell of that Crag from Sutton, but I have not seen the specimen upon which that entry is based. I have re-examined my own specimens of *Modiola* in the British Museum and do not recognise the species among them.

Modiola Petagnæ, *Scacchi.* Crag Moll., vol. ii, p. 60, Tab. VIII, fig. 6 *b* (as *M. costulata,* var. *Petagnæ*).

Localities. Cor. Crag, Sutton; and Red Crag, Walton Naze.

In the 'Crag Moll.' I figured this shell as a variety only of *costulata,* following in this respect Philippi's earlier rather than his later view, and not desiring to swell the number of species where it could be avoided. The Mediterranean authors, however, keep the two forms as distinct species, and therefore I, not from my own judgment, but in deference to these authors, have here assigned *Petagnæ* as a separate species.

Modiola phaseolina, *Phil.* Crag Moll., vol. ii, p. 59, Tab. VIII, fig. 4.

Localities. Cor. Crag, Sutton, Ramsholt, and near Orford.

This is another shell which I figured at the above reference, and I have since then found several additional specimens; but whether they be specifically distinct from the young of *Modiola modiolus* is very doubtful (see 'Crag Moll.,' p. 59). There is not, I fear, any sufficient difference in their forms, or any other character by which *phaseolina* can be specifically distinguished from *modiolus.* Both forms are present in the Crag, and I have permitted their names to remain separate.

Nucula Cobboldiæ, *J. Sow.* Crag Moll., vol. ii, p. 82, Tab. X, fig. 9; and Supplement, Tab. X, fig. 2.

Localities. Red Crag, Sutton, Bawdsey, Felixstowe, Waldringfield, and Butley. Fluvio-marine Crag, Bramerton, Thorpe, Bulchamp, Thorpe by Aldbro, and Yarn Hill. Chillesford bed, Chillesford, Aldeby, Easton Cliff, and Bramerton. Lower Glacial,

Belaugh, and Weybourn. Middle Glacial, Billockby, Clippesby, and Hopton. Upper Glacial, Dimlington, and Bridlington.

This shell has recently been identified with *N. Lyalli* from the north-west coast of America, and by others with *N. insignis* from Japan, while there is a third shell that has equal pretensions to identity, viz. *N. mirabilis* (Adams and Reeve); all these having the exterior ornamentation like that upon the upper part of *N. Cobboldiæ*, but none of these living shells, so far as they are known, approach in size any of the fossil specimens, those of *A. Lyalli* that I have seen being not more than half in linear dimension; and, as pointed out by me originally ('Crag Moll.,' vol. ii, p. 83), two Cretaceous species are similarly ornamented. All the specimens of these Pacific shells, which I have yet seen, are destitute of that broad exterior belt extending from a fourth to a third of the shell's diameter, which is free from the oblique or zig-zag markings, and forms the margin of the full-grown specimens of *N. Cobboldiæ* from the Red Crag at Butley, and from the successive Glacial beds of East Anglia. In order to show this belt I have had a specimen figured from Belaugh.

If the recent shells which I have seen and which are all destitute of this plain belt should prove to be only young individuals, which, when full grown, would acquire it, *N. Cobboldiæ* would, nevertheless, not agree with them, because the tumidity and more elevated umbo of all these Pacific shells is such, that if they grew to the size necessary to add on the belt they would assume a very different form than that of *Cobboldiæ;* and these recent shells are also more angular than our fossil. I, therefore, still retain this well-known fossil as a distinct species.

No trace of this shell has yet occurred in that part of the Red Crag which exists at Walton Naze and which I regard as the oldest part of that formation, and as possessing Mediterranean affinities, but it gets more common in the newer portions of the Red Crag with northern affinities. In the Butley Red Crag *Cobboldiæ* is common, as it is also at some localities of the Fluvio-marine Crag and of the Chillesford bed. In the Lower Glacial sands it is rare where these sands are Fluvio-marine, as at Belaugh, but commoner where they are more marine, as at Weybourne. It is very abundant, in a fragmentary condition, in the Middle Glacial sands, and it appears to be characteristically the shell of the Pre-glacial and earlier Glacial periods, and to have disappeared from British seas towards the later part of the Glacial period.[1]

The shell called *Nucula* (*Acila*) *Lyalli*, by Mr. Bell ('Ann. and Mag. Nat. Hist.,' 1871), was placed in my hands, and I believe it to be only the young state of *Cobboldiæ*.

[1] In the foot-note to p. 26 of the Introduction to this Supplement, mention is made of a thin band of sand intercalated in the upper glacial clay at Dimlington, which contained mollusca with valves united. Since that note was published some specimens from this bed were kindly forwarded by Sir Charles Lyell, and among these were several of *Nucula Cobboldiæ*. Mr. Leonard Lyell's description, which Sir Charles forwarded with the specimen, speaks of this sandband having been literally packed with perfect specimens of *Nucula Cobboldiæ*.

It was a small flat specimen, with neither the angularity of outline nor the elevated umbo of the recent Pacific shells.

Nucula lævigata, *J. Sow.* Crag Moll., vol. ii, p. 81, Tab. X, fig. 8, and var. *calva.* Supplement, Tab. VIII, fig. 5 *a*, *b*.

Localities. Red Crag passim.

Var. *calva.* Cor. Crag, Sutton and Orford.

The Coralline Crag variety differs from the typical form found in the Red Crag of Walton Naze in being smaller and more decidedly truncated, without the projecting part of the margin at the shorter or siphonal side of the valve. I propose to distinguish it as a well-marked variety under the above name, *calva.*

This variety much resembles an Oligocene shell represented by Dr. Speyer ('Die Ober Oligocänen Tertiar gebilde,' p. 42, Tab. V, figs. 3—5), called *N. peregrina*, Desh., which, judging from the figure, seems to be of a form somewhat intermediate between the Red and Cor. Crag shells, but I have not been able to procure a specimen of the German fossil for comparison.

Nucula proxima, *Say.* Crag Moll., vol. ii, p. 87, Tab. X, fig. 7 (as *N. trigonula*).

Nucula proxima, *Say.* Journ. Acad. Nat. Sc., 2, p. 270, 1822.

Localities. Cor. Crag, Sutton and near Orford.

At the above reference I observed that *N. proxima* of the American authors was probably the same as the Crag shell *trigonula,* and as I have seen no reason to alter that opinion it is only right, as the name *proxima* has priority to mine, that the shell should be here placed under that designation.

Nucula nitida, *G. Sow.* Supplement, Tab. X, fig. 12.

Nucula nitida, *G. Sow.* Conch. Illustr., *Nucula*, No. 29, fig. 20.
— — *Hanley.* Thesaurus, p. 46, pl. 229, fig. 120.

Localities. Cor. Crag, Sutton and near Orford.

As the British conchologists seem to consider this shell to be a distinct species I have here followed their example, although at page 87 of vol. ii of the 'Crag Mollusca' I considered it to be only a variety of *trigonula,* and as my specimens correspond with the recent form I have had one figured. It is less tumid than *trigonula* and has a smooth

exterior. Our present shell seems intermediate between *nucleus*, which is more extended posteriorly, and *proxima*.

NUCULA TENUIS, *Mont.* Crag Moll., vol. ii, p. 84, Tab. X, fig. 5.

Localities. Red Crag, Bawdsey. Fluvio-marine Crag, Bramerton (*Reeve*). Chillesford bed, Chillesford, Bramerton (*Reeve*), and Aldeby (*Crowfoot & Dowson*). Middle Glacial, Hopton? Upper Glacial, Bridlington.

I have seen the specimens from all the above localities. Those from Hopton are fragmentary and may belong to *nucleus*, but more probably to the present species.

LEDA OBLONGOIDES, *S. Wood.* Crag Moll., vol. ii, p.90, Tab. X, fig. 17 (as *Leda myalis*, Couth.).

NUCULA OBLONGOIDES, *S. Wood.* Mag. Nat. Hist., New. Ser., vol. iv, p. 297, tab. 14, fig. 4, 1840.

Localities. Red Crag, Sutton and Butley, Fluvio-marine Crag, Bramerton, Thorpe, Bulchamp, Thorpe by Aldbro, and Yarn Hill. Chillesford bed, Chillesford, Aldeby, Easton Cliff, Bramerton, Horstead, Coltishall, and Burgh. Lower Glacial, Belaugh, and Rackheath. Middle Glacial, Hopton and Billockby.

The shell figured No. 17 in Tab. X of vol. ii of 'Crag Moll.' as *L. myalis*, Couthouy, can, I think, hardly be referred to that species. It is the same as that figured No. 4 of tab. 14 of vol. iv of 'Mag. Nat. Hist.,' New Series, to which I gave the name of *oblongoides*. This shell is common in the newer part of the Red Crag (that of Butley) and in the Fluvio-marine Crag at Thorpe by Aldbro, Bulchamp, and Bramerton, and also in the Chillesford bed at all its localities, and in all it maintains well its form and characters. I for some time thought it to be identical with the North East American shell, *limatula*, Say, but it is less attenuated, and has not the preponderance in length of the hinder (or posterior) part of the shell over the anterior which characterises that species, and the ligamental socket is larger. It also approaches, in some respects, all of the following, viz. *hyperborea*, Torel; *amygdalea*, Valenciennes; *sapotilla*, Gould; *myalis*, Couth.; and *Woodwardi*, Hanley, which, perhaps, are all varieties of one species; but I cannot satisfactorily identify it with any of them, though it seems to come nearest to *hyperborea*. I have, therefore, fallen back upon my original name *oblongoides*. The figure in the 'Ann. and Mag. of Nat. Hist.' is a most accurate representation of it. The shell occurs in the Lower Glacial sands of Belaugh and Rackheath, and fragments (sometimes large) of what seems to be the same species are very common in the Middle

Glacial of Hopton Cliff.[1] The *Leda hyperborea* of Mr. A. Bell's list in 'Ann. and Mag.,' Sept., 1870, from Butley, is, I think, the above *oblongoides.*

LEDA SEMISTRIATA, *S. Wood.* Crag Moll., vol. ii, p. 91, Tab. X, fig. 10.

In his list in White's 'Directory,' Dr. Woodward gave, on the authority of a single valve in the Middleton collection, this species from the Norwich Crag. I suspect that this was a spurious specimen. I know this species from no newer bed than the Coralline Crag.

LEDA LANCEOLATA, *J. Sow.* Crag Moll., vol. ii, p. 88, Tab. X, fig. 16.

Localities. Red Crag, Bawdsey. Fluvio-marine Crag, Bramerton. Chillesford bed, Chillesford. Middle Glacial, Hopton.

A considerable fragment of this shell, exhibiting the wavy line ornamentation of the exterior, has occurred in the Middle Glacial sand of Hopton, and a similar fragment in the Fluvio-marine Crag of Bramerton.

LEDA MYALIS? *Couthouy.* Supplement, Tab. IX, fig. 2 *a, b.*

NUCULA MYALIS, *Couth.* Bost. Journ. Nat. Hist., vol. ii, p. 61, pl. 3, fig. 7, 1838.

Locality. Fluvio-marine Crag, Postwick. Lower Glacial, Runton.

The specimen figured is one in the British Museum, and agrees with the recent *myalis* of Couthouy in all respects, but I question whether after all it is anything more than an extreme form of the preceding species *oblongoides.* The specimen figured is, with another valve in the British Museum, marked "Postwick," and a third there is marked "Runton" which can only be from the Lower Glacial sands, which are fossilliferous at that place.

Fig. 13 *a, b,* of 'Crag Moll.,' Tab. X, may retain the name of *L. caudata,* Donovan, and fig. 12 *a, b,* of the same plate I will refer to *minuta,* Mont. This latter is from the Red Crag, and the *caudata* is the Bridlington form.

[1] It is the shell referred to under the name *limatula* in the list in 'Quart. Journ. Geol. Soc.,' vol. xxvi, p. 94.

ARCA TETRAGONA, *Poli.* Crag Moll., vol. ii, p. 76, Tab. X, fig. 1.

Localities. Cor. Crag, Sutton, Ramsholt, and Sudbourn. Red Crag, Sutton.

The specimen represented in figs. 1 *a* and *b* ('Crag Moll.') is from the Red Crag at Sutton, and it was there considered as belonging to the above-named species; figs. 1 *c* and 1 *d* are from the Coralline Crag. In the 'Brit. Conch.,' vol. ii, p. 181, *A. tetragona* is stated to be in the Red and Cor. Crag, but in the list accompanying Mr. Prestwich's paper this species (*tetragona*) is given from the Cor. Crag only, while my shell from the Red Crag is referred by this author to *A. imbricata,* Poli. In consequence of this statement I have again examined and compared my specimens with the Mediterranean shell, but must still retain my previously formed opinion.

PECTUNCULUS GLYCIMERIS, *Linn.* Crag Moll., vol. ii, p. 66, Tab. IX, fig. 1.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Bramerton. Chillesford bed, Aldeby. Middle Glacial, Billockby and Hopton. Upper Glacial, Bridlington.

The genus *Pectunculus* is one in which the species are of very difficult determination, as may be seen by the number of synonyms given by various authors, and the little accordance there is as to specific separation. In the Cor. Crag the prevailing form is the thick variety, corresponding in this respect with the Mediterranean shell or rather with the Sicilian fossils, but I have also found in the Cor. Crag the thinner and less tumid shell, like that of the recent British variety. In the 'Crag Moll.' I gave *P. glycimeris* and *P. pilosus* as varieties of one species, following the authors of the 'Brit. Moll.,' and I see no sufficient reason to alter that opinion. All I can say is that, if there be two species, as appear to be made out of these two varieties by some authors, they are both present in the Coralline Crag as well as in the Red. Mr. Canham has obtained from the Red Crag at Waldringfield a specimen which measured $3\frac{3}{4}$ of an inch in one direction and $3\frac{1}{2}$ in the other, and this of great solidity, and with these are specimens thin and oblique, while some have prominent umbones; in others this part is much depressed, with every intermediate shade of difference. It is difficult to say whether the thick shells in the Red Crag are, like the thinner ones, natives of the Red Crag sea, or whether they be derived from the Cor. Crag, as I think there can be no doubt that a large proportion of the *Pectunculi,* which make up the mass of the thin bed at the base of the Red Crag, from which the phosphatic nodules are extracted, have been thus derived. *P. stellatus* and *P. insubricus* are, I believe, mere varieties of this species. *P. glycimeris* (I presume the thin

variety) was for many years almost unique in the Fluvio-marine Crag, but it has been found somewhat plentifully in a newly worked pit at Bramerton. A single worn specimen of small size, found by Messrs. Crowfoot and Dowson, is the only instance of its occurrence in the Chillesford Bed. It has not occurred in the Lower Glacial sands, but it abounds in the Middle Glacial, both at Billockby and Hopton, where specimens of all sizes occur, from the smallest fry up to the ordinary size of the British shell. I have not seen even a fragment from that formation of those larger or more solid forms occurring in the Cor. and Red Crags.

Fig. 1 *d* of Tab. IX of 'Crag Moll.' corresponds with what Brocchi has called a species under the name of *A. inflata*, and Mr. A. Bell gives *P. insubricus*, Broc. (*violascens*, Lam.), also as in Cor. Crag. Some specimens which I have seen that somewhat resemble these so-called species are, I believe, only varieties. Mr. Jeffreys, in his list of the Crag shells, gives *glycimeris* only from the Cor. Crag, but introduces *P. pilosus* as a new Red Crag shell. If these be really two distinct species I would rather reverse this determination, and while giving *pilosus* to the Cor. Crag, regard that form as only derivative in the Red.

LIMOPSIS PYGMÆA, *Phil.* Crag Moll., vol. ii, p. 71, Tab. IX, fig. 3.

Localities. Cor. Crag, Sutton, and near Orford. Red Crag, Walton, Waldringfield, and Felixstow. Middle Glacial, Billockby.

This shell, according to M. Meyer ('Cat. Syst. Ter.,' p. 120), is *Trigonocœlia anomala*, Eichwald, 1830, not *pygmæus*, Munster, and, according to Mr. Jeffreys, it has recently been dredged living near Corsica, and in abysmal depths in the Atlantic. Mr. Bell gives the species as occurring at Walton ('Ann. and Mag. Nat. Hist.,' 1870), also from Waldringfield and Felixstow. A single perfect valve has occurred in the Middle Glacial sand of Billockby. It is a most abundant shell in the Cor. Crag of Sutton, where the two valves are frequently united.

LIMOPSIS AURITA, *Brocchi.* Crag Moll., vol. ii, p. 70, Tab. IX, fig. 2.

This shell is very abundant in the Cor. Crag, near Orford, but I have never found it in the Red Crag, with one doubtful exception. Mr. Jeffreys gives it in his list from the Red Crag at Waldringfield (I presume on Mr. Bell's authority). This is given by Mr Jeffreys as a shell living in the Shetland seas, and though no uncommon fossil in the Italian beds, it has not, I believe, been yet found living in the Mediterranean.

UNIO PICTORUM, *Linné.* Supplement, Tab. VIII, fig. 3.

Locality. Post Glacial, Grays.

In the 'Crag. Moll.,' vol. ii, p. 99, Tab. XI, fig. 13, is the representation of a shell from Stutton, which is there called *M. tumidus,* but the specimen was not in very perfect condition, and its correct reference is by no means certain. The specific line of separation between *tumidus* and *pictorum* is not easily determinable even in the recent state, and less so with fossils. The specimen here figured was found by Mr. Pickering at Grays, and to which he has given the above name.

UNIO TUMIDUS, *Philippsson.* Supplement, Tab. VIII, figs. 2 *a, b.*

Locality. Post Glacial, Grays.

This is one of a group which is exceedingly abundant; indeed, it was the only form I could find at that locality after many days' search. It is a peculiar variety, being more inequilateral than any recent specimens of that name which I have seen, the pedal side being peculiarly short. The specimens at Grays lie there in myriads, but I have never seen one approaching the dimensions of the recent shell, which is said to have reached four and a half inches in length. The Grays specimens never exceed three inches, and rarely attain to that size. In deference to those authors who have distinguished *tumidus* from *pictorum* I have kept the two forms as distinct species, but in my opinion the two graduate into each other, and are not distinguishable.

In 1864 I found an imperfect specimen of *Unio* in the Fluvio-marine Crag at Bramerton, but unfortunately this was not perfect enough for representation or determination. It appeared to resemble *M. tumidus,* and I have provisionally referred it to that species. This same inequilateral form *tumidus* also occurs at the base of the bed E of Sect. V (Kessingland) of the map sheet accompanying the introduction to this Supplement.

UNIO LITTORALIS, *Lam.* Crag Moll., vol. ii, p. 98, Tab. XI, fig. 12.

I have hunted at Grays for several years without finding this species, and Mr. Pickering tells me he has not been able to find it there, but Sir Charles Lyell has shown me some specimens which he obtained at that locality many years ago, that undoubtedly belong to this species.

ANODONTA CYGNEA, *Linn.* Crag Moll., vol. ii, p. 102, Tab. II, fig. 10.

This is also an abundant shell at Grays, and by no means scarce at Clacton, but from extreme fragility specimens are difficult to obtain. I have also found in the bed at Runton (C of Sect. III of the map sheet) the variety *anatina* or *paludosa*, 'Turt. Brit. Biv.,' p. 240, Tab. 15, fig. 6, in which the dorsal and ventral margins are nearly parallel. My specimen from Runton measures nearly five inches in length.

Unio margaritifer is given by Mr. Prestwich in the 'Quart Journ. Geol. Soc.,' vol. xxvii, p. 467, as a species from near Runton Gap on the Norfolk Coast, but this appears to be an error, as pointed out by Mr. A. Bell in 'Geol. Mag.,' vol. ix, p. 214. I do not know this shell as a British fossil.

CORBICULA FLUMINALIS, *Müller.* Crag. Moll., vol. ii, p. 104, Tab. XI, fig. 15, as *Cyrena consobrina.*

Localities. Red Crag, Waldringfield (*A. Bell*). Fluvio-marine Crag. Thorpe, near Aldbro (*S. Wood*). Dunwich (*Crowfoot*). Bramerton and Postwick (*Woodward*). Bulchamp (*Dowson*). Lower Glacial, Belaugh (*Harmer*). Post Glacial, Bramwell near Cambridge (*Bell*). Kelsea Hill, Gedgrave near Orford, Stutton-on-Stour, Grays, and Clacton (*Fisher*).

This shell (like several European freshwater bivalves) has a great number of synonyms,[1] and it is an important species as concerns the post glacial sequence of deposits. It is somewhat variable, but not more so than other of our freshwater inhabitants. It has been said that freshwater shells vary more than marine, but I have never seen greater variation among them than is exhibited by the varieties and distortions shown by fossil specimens of *Trophon antiquus* and *Littorina littorea.*

The Red Crag appears to be the oldest deposit in which *Corbicula fluminalis* has been met with in this country. The specimens of this species mentioned by me as having been found on the top of the Cor. Crag at Gedgrave ('Crag Moll.,' vol. ii, p. 105) belong to what is probably one of the older Post Glacial deposits, into which some of the Cor. Crag fossils have been washed. It appears to have lived in Britain before the very severe conditions of the Glacial Period had set in, and we find it again an inhabitant of our waters in deposits more recent than those of that epoch, but all the specimens that I have seen from the beds of Crag age, as well as the solitary specimen I have seen from the Lower Glacial sands at Belaugh, are small; the largest of them scarcely more than half

[1] This species, including the fossil in Europe and the recent shell from the Nile and China, has had given to it five generic and sixteen specific names. Mr. Gregory ('Geol. Mag.,' vol. vi, p. 81) gives this as living in the Vaal River, South Africa.

the linear dimensions of the shells that occur in the Post Glacial valley deposit of Stutton.[1]

This *Corbicula* lived here in association with a few other Molluscs which have disappeared from the British Isles, viz. *Unio littoralis*, *Hydrobia marginata*, *Helix fruticum*, and *Helix ruderata*, the two former of which have survived not far to the southward of us, while the two latter have gone north, and are now found in Siberia and North America, extending in a northerly direction up to the Arctic Circle.

FRAGILLIDÆ.

There are several small and tender bivalves in the Coralline Crag, figured and described in the 'Crag Moll.,' which I think might be united in one family under the name of *Fragillidæ*, separating them into genera or sections, the formula for each of which is here given. The specific name annexed may be considered the type of each.

Lepton, Turton (*squamosum*, Mont.). Shell thin, roundedly ovate or obtusely triangular, equivalved, equilateral, slightly compressed; surface of valves pitted or ornamented; beaks generally acute; margins plain; hinge with two lateral teeth in each valve, and one small cardinal tooth. Palleal line simple; connexus cartilaginous.

Lasæa, Leach (*rubra*, Mont.). Shell small, thin, inequilateral, equivalved, oval or oblong, closed, externally smooth or covered with fine lines of growth; beaks depressed; hinge with two prominent lateral teeth and one small cardinal tooth; palleal line simple; connexus cartilaginous. The animal is said to have a tubular prolongation in front of the mantle.

Bornia, Philippi (*ovalis*, S. Wood). Shell smooth, thin, ovate, or subtriangular equivalved, slightly compressed, closed; hinge with two diverging teeth in each valve; palleal line simple; connexus cartilaginous.

Scacchia, Philippi (*elliptica*, Scac.). Shell small, thin, ovate or elliptical smooth, inequilateral, closed; two cardinal teeth in one valve and one in the other; palleal line simple; connexus cartilaginous.

Scintilla, Deshayes (*ambigua*, Nyst). Shell ovately transverse, thin, equivalved, equilateral, smooth, closed; two teeth in one valve and one prominent obtuse tooth in the other; palleal line simple; connexus cartilaginous. *Sportella* resembles this, but it has a ligamentous connector. This latter I have not seen from the Crag, but it is not rare in the Older Tertiaries.

Kellia, Turton (*suborbicularis*, Mont.). Shell thin, suborbicular, or slightly transverse equilateral, smooth, closed; hinge with two teeth in each valve, one before and the other behind the connector; palleal line simple; connexus cartilaginous.

[1] The Stutton Post glacial deposit is in the low ground skirting the estuary of the Stour, opposite Manningtree, and is not to be confounded with the well-known Crag locality of Sutton in the same county

Montacuta, Turton (*bidentata*, Mont.). Shell small, thin, transverse or oblong smooth; equivalved, inequilateral; two cardinal teeth in each valve, the hinder one formed by the backward pressure of the connector. Palleal line simple. Connexus cartilaginous.

Sphenalia, S. Wood (*substriata*, Mont.). Shell small, thin, transverse, oblong, or wedge-shaped; equivalved; very inequilateral, compressed, smooth; hinge edentulous or with one obsolete tooth in each valve formed by the elevated side of the pit for the connector. Palleal line simple. Connexus cartilaginous.

Crag Species.

Lepton squamosum, Mont. Crag Moll., vol. ii, p. 114, Tab. XI, fig. 8.
— *nitidum*, Turt. Crag Moll., vol. ii, p. 116, Tab. XI, fig. 7.
— *deltoïdeum*, S. Wood. Crag Moll., vol. ii, p. 115, Tab. XI, fig. 9.
— *depressum*, Nyst. Crag Moll., vol. ii, p. 116, Tab. XI, fig. 6.
Lasæa rubra, Mont. (*Kellia*). Crag Moll., vol. ii, p. 125, Tab. XI, fig. 10.
— *pumila*, S. Wood (*Kellia*). Crag Moll., vol. ii, p. 124, Tab. XII, fig. 15.
— *Clarkiæ*, Clark. Supplement, Tab. IX, fig. 10.
— *intermedia*, S. Wood.[1] Supplement, Tab. X, fig. 22.
Bornia ovalis, S. Wood. Supplement, Tab. IX, fig. 3.
Scacchia elliptica, Phil. (*Kellia*). Crag Moll., vol. ii, p. 121, Tab. XII, fig. 13.
— *cycladia*, S. Wood (*Kellia*). Crag Moll., vol. ii, p. 122, Tab. XI, fig. 4.
— *orbicularis*, S. Wood (*Kellia*). Crag Moll., vol. ii, p. 120, Tab. XII, fig. 9.
Scintilla ambigua, Nyst (*Kellia*). Crag Moll., vol. ii, p. 120, Tab. XII, fig. 11.
— *compressa*, Phil. (*Kellia coarctata*). Crag Moll., vol. ii, p. 123, Tab. XII, fig. 10.
Kellia suborbicularis, Mont. Crag Moll., vol. ii, p. 119, Tab.XII, fig. 8.
Montacuta bidentata, Mont. Crag Moll., vol. ii, p. 126, Tab. XII, fig. 17.
— *elliptica*, S. Wood. Supplement, Tab. X, fig. 21.
— *truncata*, S. Wood. Crag Moll., vol. ii, p. 127, Tab. XII, fig. 16.
— *ferruginosa*, Mont. Crag Moll., vol. ii, p. 129, Tab. XII, fig. 14.
Sphenalia substriata, Mont. (*Montacuta*). Crag Moll., vol. ii, p. 128, Tab. XII, fig. 12.
— *donacina*, S. Wood (*Montacuta*). Crag Moll., vol. ii, p. 131, Tab. XI, fig. 3.
Cryptodon rotundatum, S. Wood. Crag Moll., vol. ii, p. 135, Tab. XII, fig. 19 (as *Cryptodon ferruginosum*.
— *sinuosum*, Donovan. Crag Moll., vol. ii, p. 134, Tab. XII, fig. 20.

[1] This is from Aldeby.

LEPTON NITIDUM, *Turton*. Supplement, Tab. IX, figs. 7 *a*, *b*, *c*.

Localities. Cor. Crag, Sutton. Fluvio-marine Crag, Bramerton. Chillesford bed, Aldeby and Beccles.

The specimen figured in 'Crag Moll.,' vol. ii, Tab. XI, fig. 7, under the above name, is, I now believe, the same as *L. depressum*, Nyst (fig. 6 of the same Tab.), which I think is distinct from *nitidum*. I have recently found in the Cor. Crag at Sutton the specimen represented as above, which I have no doubt is the shell called *nitidum* by Turton, and Mr. Canham showed me a similar one from the same locality. A specimen was sent to me by Mr. Reeve from Bramerton, and Messrs. Crowfoot and Dawson have sent one from Aldeby and several from the Waterworks Well at Beccles, which may be referred to the same species. These latter are from the Chillesford bed.

LEPTON DELTOIDEUM, *S. Wood.* Crag Moll., vol. ii, p. 115, Tab. XI, fig. 9.

Localities. As in 'Crag Moll.'

This shell is given by Dr. Hörnes ('Vienna Foss.,' p. 249, and by M. Weinkauff, 'Conch. des Mitt.,' p. 178) as a synonym to *Bornia corbuloides*, but that shell has a smooth exterior, while the Crag shell is covered with a kind of wavy granular ornament. Mr. Jeffreys, in his list to Mr. Prestwich's paper, 'Geol. Journ.,' vol. xxvii, p. 139, referred the Crag shell (*deltoideum*) to *Erycina Geoffroyi*, Payr. He has since, however, written me that he was in error in so doing, and that he now considers the shell to be identical with *corbuloides;* he also sent me two specimens of that species for comparison. These proved to be entirely destitute of any external ornament, the presence of which is so marked a characteristic of the Crag *deltoideum*. Under these circumstances I have retained my Crag shell as a distinct species. The specimens from the Red Crag are slightly worn, but the ornament may be detected by means of a lens; these have a slight depression in the central part of each valve.

LASÆA CLARKIÆ, *Clark.* Supplement, Tab. IX, fig. 10.

LEPTON CLARKIÆ, *Clark.* Ann. Nat. Hist., 2nd ser., 1852, p. 293, and vol. ix, p. 191.
— — *Forbes* and *Hanl.* Brit. Moll., vol. vi, p. 255, pl. cxxxii, fig. 7.
— — *Jeffreys*, Brit. Conch., vol. ii, p. 202, pl. xxxi, fig. 5.

Locality. Cor. Crag, Sutton.

Length, $\frac{1}{16}$ of an inch; *height*, $\frac{1}{20}$ inch.

This shell I have placed in the genus *Lasæa,* as it corresponds in its dentition with *Lasæa rubra,* and it has not the peculiar ornament of *Lepton* upon the exterior, but is covered with concentric striæ or fine lines of growth. Mr. Jeffreys describes the recent shell as being "marked with longitudinal radiating lines" ('Brit. Conch.,' vol. ii, p. 203); these are not visible in my fossil, but my specimens are rare.

LASÆA INTERMEDIA, *S. Wood.* Supplement, Tab. X, fig. 22.

Localities. Chillesford Bed, Aldeby. Middle Glacial, Hopton.

The specimen figured was sent to me by Messrs. Crowfoot and Dowson, who found it with some others at Aldeby, and a single perfect specimen of the same species has been found by my son in the Hopton Sand.

It resembles *Lasæa pumila* of the Cor. Crag in size and outline, but it is much flatter or more compressed, and it differs essentially in its dentition. Our present shell is transversely ovate, very inequilateral, compressed, and with a smooth exterior; the right valve has a rudimentary cardinal tooth and a very elongated lateral tooth on the longer or pedal side, with a small one on the other nearly at right angles; the left valve has corresponding denticles, but not so prominent.

At first I thought the present shell might be referred to *M. Dawsoni*, 'Brit. Conch.,' vol. ii, p. 178, but Mr. Jeffreys, who examined the Aldeby specimens, said "this little bivalve is, I consider, the younger state of your *Kellia pumila. Montacuta Dawsoni* differs from it in being flatter and having no cardinal tooth, the lateral teeth being very much shorter and stronger." The denticles of my shell are much longer than in either *pumila* or *Dawsoni;* and I have, therefore, for the present, kept them distinct. My shell is by no means thin, and the anterior muscle-mark is large and deeply impressed, from which I think it is fnll grown.

BORNIA OVALIS, *S. Wood.* Supplement, Tab. IX, figs. 3 *a*, *b*.

Locality. Cor. Crag, Sutton.

Length, $\frac{5}{16}$ths of an inch.

Two specimens, both unfortunately of the same value, have lately been found by myself, and I am unable satisfactorily to refer them to a known species. My shell has two short but prominent diverging teeth, one on each side of the depression for the cartilaginous connector. There is an indentation in the umbo which much resembles that present in some species of *Cochlodesma,* through which the cartilage protrudes. This opening may have been made in a similar manner, or it may be accidental.

I have, from these imperfect materials, declined giving a diagnosis.

In the 'Crag Moll.,' vol. ii, p. 132, I described a small shell under the provisional name of *Cyamium eximium.* I am sorry to say that I have seen nothing since that will assist in its correct determination; and the specimen itself has been subsequently much injured. It may probably be a small or young individual of the above. Under these circumstances I have thought it best to suppress the name *Cyamium eximium* in the general list which accompanies this Supplement.

SCACCHIA CYCLADIA, *S. Wood.* Crag Moll., vol. ii, p. 122, Tab. XI, fig. 4 (as *Kellia cycladia*).

Locality. As in 'Crag Moll.'

This shell is still very rare to my researches. I have not met with a specimen since the one above referred to was engraved, but I have re-examined my specimens given to the British Museum, and think them quite distinct from *Scacchia* (*Kellia*) *orbicularis.*

Anatina ? pusilla, Phil., 'En. Moll. Sic.,' vol. i, p. 9, Tab. 2, fig. 5, may possibly be the same as my Crag shell, but it will be necessary to compare specimens before such identity can be established.

SCACCHIA ORBICULARIS, *S. Wood.* Crag Moll., vol. ii, p. 120, Tab. XII, fig. 9 (as *Kellia orbicularis*); and Supplement, Tab. IX, fig. 9.

Localities. As in 'Crag Moll.'

The shell figured in the present Supplement is a very globose variety of this species, without the obliquity generally observable, from which I at first imagined it was a distinct species. Specimens of *orbicularis* have lately been obtained by Mr. Jeffreys in the living state, and he has referred them to *Scacchia cycladia* (*Kellia cycladia,* 'Crag Moll.'). I, however, believe the species to be distinct.

KELLIA SUBORBICULARIS, *Mont.* Crag Moll., vol. ii, p. 118, Tab. XII, fig. 8.

Localities. As in 'Crag. Moll.'

If this be not one of the boring bivalves, it is a shell that is often found in a crypt with a true excavator, as I have found a perfect specimen of it in association with the valves of a *Gastrochæna* in a crypt formed in a fragment of an *Ostrea* from the Cor. Crag of Sutton, and it was of that size that it could not escape through the terminal opening; moreover, it was in the crypt in front of the valves of the *Gastrochæna.* This species (*suborbicularis*) has an extensive range in the living state, and I have a specimen from the Coast of California, given to me by Dr. P. Carpenter, in which I cannot detect the slightest difference from the recent shell of our own seas or from my Crag fossil. Mr.

Charlesworth has shown me a specimen of *suborbicularis* from the Red Crag in a crypt with a *Pholas*.

The new species of *Kellia* described by Forbes in his 'Ægean Report,' 1843, cannot now be found, and his short descriptions, unaccompanied by figures, are insufficient for specific determination. Perhaps his *Kellia transversa* may be the same as my *Scacchia cycladia*, but I cannot alter the name of my shell upon such uncertainty.

SCINTILLA AMBIGUA, *Nyst*. Crag Moll., vol. ii, p. 120, Tab. XII, fig. 11 (as *Kellia ambigua*).

SCINTILLA AMBIGUA? *Desh.* An. sans. Vert., t. i, p. 700, pl. xlix, figs. 13—15.

Localities. Cor. Crag, Sutton, and near Orford. Red Crag, Walton and Sutton. Chillesford Bed, Chillesford and Aldeby.

In Mr. Jeffreys' list of Cor. Crag shells ('Quart. Journ. Geo. Soc.,' vol. xxvii, p. 139) this species is referred to *Erycina pusilla*, Phil., but in the same Journal subsequently, at p. 493, Mr. Jeffreys says that "*Kellia ambigua* is not *Erycina pusilla*, Phil., but *Scintilla Parisiensis* of Conti." He has since written to me that he now refers it to *Kellia Geoffroyi*, Payr, of which he sent me a specimen for comparison. I find that shell, however, to be covered with fine radiating lines, of which I can detect no trace in the numerous specimens of *ambigua* in good preservation which I have examined. I have therefore retained the name *ambigua*, Nyst, under which I originally described this shell, merely changing the generic appellation.

The name of *Scacchia elliptica* is given in the same list by Mr. Jeffreys, at p. 485, as a species new to the Red Crag. On application to Dr. Reed, of York, in whose cabinet is the specimen on which this introduction of the species as a Red Crag shell is founded, he obligingly sent it to me for examination, and I find it to belong to *Scintilla ambigua*, which I had given as a Red Crag species in 'Crag Moll.,' vol. ii, p. 121. *Scacchia elliptica* is abundant in the Cor. Crag at Sutton, as is also *Scintilla ambigua*, but the latter becomes very rare in the newer Formations (where it appears to have died out), and is, moreover, exceedingly variable in its outline as well as in the degree of its tumidity.

MONTACUTA BIDENTATA, *Mont.* Crag Moll., vol. ii, p. 126, Tab. XII, fig. 17.

Localities. Cor. Crag, Sutton, and near Orford. Red Crag, Walton Naze. Chillesford Bed, Aldeby. Middle Glacial, Hopton. Post Glacial, Nar Brickearth, at Pentney.

This species has been obtained by Messrs. Crowfoot and Dowson from Aldeby, by my son (a single valve) from Hopton, and by Mr. Rose from Pentney. The specimen upon which the species was given as from Bridlington in 'Mem. Geol. Survey,' vol. i, p. 409, 1846, was in the Bowerbank collection now in the British Museum, and had,

according to information furnished me by the late Dr. Woodward, a memorandum on the back of the tablet, stating that it came from the Nar Brickearth, where the shell has been found by Mr. Rose. I have, therefore, omitted the locality of Bridlington for it. The figure in 'Crag Mollusca' is not quite accurate, the posterior side being a little too rounded for the general form of the Crag specimens.

MONTACUTA FERRUGINOSA, *Mont.* Crag Moll., vol. ii, p. 129, Tab. XII, fig. 14.

Localities. Cor. Crag, Sutton, and near Orford. Chillesford Bed, Aldeby.

Specimens of this species were among the shells from time to time sent me for examination by Messrs. Crowfoot and Dowson from Aldeby.

MONTACUTA ELLIPTICA, *S. Wood.* Supplement Tab. X, fig. 21.

Locality. Coralline Crag, Sutton.

The above figure represents a specimen of *Montacuta*, which appears to be distinct from the shell called *bidentata.* It has the posterior side more rounded and more extended than *bidentata,* and is less inequilateral. It is also less compressed and more elliptical, and has the denticles comparatively longer.

Genus.—SPHENALIA (see ante, p. 121).

SPHENALIA DONACINA, *S. Wood.* Crag Moll., vol. ii, p. 131, Tab. XI, fig. 3 (as *Montacuta? donacina*).

Localities. As in Crag Moll.

A Coralline Crag shell from Sutton was described in the 'Crag Mollusca' under the above provisional name. It, however, does not in the hinge accord with *Montacuta bidentata,* the type of the genus *Montacuta,* and I have accordingly changed its position. I am sorry to say that the Crag fossil is still very rare in my collection. A recent British specimen has been procured by Mr. Jeffreys, which he has referred to my species, and he is equally at a loss where to place it. He says ('Brit. Conch.,' vol. ii, p. 216), "in shape it is a miniature *Zenatia,* a genus founded by Dr. Gray, but having an external ligament." The shell, however, given by Messrs. H. and A. Adams as the type of *Zenatia* ('Gen. of Recent Moll.,' vol. ii, p. 384, plate cii, fig. 1, *Z. acinaces*) is an aberrant form of *Lutraria,* with a deep sinus in the mantle mark. The nearest approach to this species seems to me to be the succeeding species *substriata.*

SPHENALIA SUBSTRIATA, *Mont.* Crag Moll., vol. ii, p. 128, Tab. XII, fig. 12 (as *Montacuta substriata*); Supplement, Tab. X, fig. 20.

Localities. Cor. Crag, Sutton, and near Orford. Chillesford Bed, Aldeby.

The figure in Supplement, Tab. X, represents a small specimen showing a difference in form from the full-grown shell, being much less inequilateral, the umbo being nearly central, which was found by Messrs. Crowfoot and Dowson at Aldeby. Mr. Jeffreys says ('Brit. Conch.,' vol. v, p. 177), " the fry of *substriata* are nearly globular, like *Kellia suborbicularis,* with the beak in the middle of the dorsal area."

CRYPTODON ROTUNDATUM, *S. Wood.* Crag Moll., vol. ii, p. 135, Tab. XII, fig. 19 (as *C. ferruginosum*).

CRYPTODON ROTUNDATUM, *S. Wood.* Ann. and Mag. Nat. Hist., 1840, p. 247.

Conceiving that I had erroneously referred my Crag shell, I applied to Mr. Jeffreys for the sight of his recent specimens, and he obligingly sent me a suite of *ferruginosum*, as also of *Croulinensis* for comparison, and I now believe my fossil to be distinct from either, although it more closely resembles the latter species. Both *ferruginosum* and *Croulinensis* are united by Forbes and Hanley, but if the two be recognised by conchologists I must consider my shell as distinct from either. The Crag form differs from *Croulinensis* in the hinge region, that shell being destitute of the depression possessed by the Crag one on the anterior side of the umbo, and from *ferruginosum* in its obliquity. It is not improbable that the Crag shell was the common ancestor of both the living species. I have, therefore, restored to my Crag form the name originally given to it in my 'Catalogue of Shells from the Crag of 1840.' I know it only from the Coralline Crag at Sutton, and there it is very rare.

LORIPES DIVARICATUS, *Linn.* Crag Moll., vol. ii, p. 137, Tab. XII, fig. 4.

Localities. Red Crag, Sutton. Fluvio-marine Crag, Bramerton and Thorpe. Middle Glacial, Hopton.

This shell has not appeared in the oldest part of the Red Crag, that of Walton, nor is it common in the newer portions. It is not uncommon in one of the pits at Bramerton, but has not yet occurred in the Chillesford bed at any of its localities. One perfect valve and some fragments have been obtained from the Middle Glacial sand.

The fragment represented in Supplemental Tab. X, fig. 18, was figured under the idea that it belonged to *Loripes lacteus,* Linn.; but a re-examination of it has induced me to doubt whether it be anything more than a fragment of some other bivalve in which a

small piece has broken out of the hinge. It is from the Middle Glacial sand of Hopton, and, like most of the specimens in that sand, is worn.

LUCINA BOREALIS. Crag Moll., vol. ii, p. 139, Tab. XII, fig. 1; Supplement, Tab. IX, fig. 5.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag passim. Chillesford Bed, Chillesford, Bramerton, Aldeby, Easton, and Horstead. Lower Glacial, Weybourne (*Reeve*). Middle Glacial, Hopton and Billockby.

This species is exceedingly common in the Cor. and Red Crags, as also in the Middle Glacial Sands at Hopton, but in this latter it is generally in a fragmentary condition, the only perfect valves that have occurred from these sands being those of very young shells.

The shell figured in this 'Supplement' (Tab. IX, fig. 5) is of a specimen sent to me by Messrs. Crowfoot and Dowson, who found it at Aldeby. In form it strongly resembles *L. spinifera,* but I believe it is merely a distorted specimen of *L. borealis.*

DIPLODONTA DILATATA, *S. Wood.* Crag Moll., vol. ii, p. 145, Tab. XII, fig. 5.

Localities. As in 'Crag Mollusca.'

This was so called from a presumption that it was specifically distinct from *rotundata,* which I still believe it to be. I also, in the 'Crag Mollusca,' placed *D. dilatata,* Sow., from the older tertiaries of Sussex, as a synonym; and gave as another synonym the shell figured by Nyst under the name of *D. dilatata,* Phil. The shell figured by Philippi under this name was, however, referred by him in a subsequent volume to *D. rotundata* ('Phil.,' vol. ii, p. 24); while the shell figured by Nyst, and referred by him to Philippi's so-called *dilatata,* is now called by Nyst *D. Woodii,* apparently under the impression that Philippi's *dilatata* is a subsisting species, instead of its being the same as *D. rotundata.* Nyst's figure ('Coq. Foss. de Belg.,' pl. 7, fig. 1) corresponds with the Crag shell, but his description, "son coté postérieur est très elargé et subanguleux," does not. My shell is also, I now believe, distinct from *D. dilatata,* Sow., of Dixon's 'Geology of Sussex.' The nearest approach to it that I know is a shell from Grignon (*D. profunda,* Desh.), but that is also, I believe, distinct. Under these circumstances I have retained the Crag shell under the original name given by me to it in 1840, although it is placed by the author of the 'Brit. Conch.' as a variety only of *rotundata.* *D. dilatata* is given by the late Dr. S. P. Woodward in his list of Norwich Crag shells, but there is no authority attached to this name (unfortunately there are but few authorities for names in that list), and I am not certain whether the species he speaks of be the *rotundata* of Mont., or *dilatata,* S. Wood.

Diplodonta Astartea, *Nyst.* Crag Moll., vol. ii, p. 146, Tab. XII, fig. 2.

Localities. Cor. Crag, Sutton. Red Crag, Sutton. Fluvio-marine Crag, Bramerton.

The shell with this name may be the same as *D. trigonula*, Bronn, *D. apicalis*, Phil., although this latter author keeps the two specifically separated, but our Crag fossil seems to have attained to larger proportions.

The figure in the 'Crag Mollusca' was taken from a Red Crag specimen, but I mentioned (p. 146) that the Coralline Crag form differed somewhat from that of the Red, but not sufficiently so to justify a separation of the two, and I am still of the same opinion.

The species is given in Dr. Woodward's Norwich Crag List in White's 'Directory' as from the Fluvio-marine Crag; and this is confirmed by a specimen of it having recently been obtained by Mr. Harmer from Bramerton.

Lucinopsis undata, *Pennant.* Supplement, Tab. IX, fig. 4 *a—b.*

Venus undata, *Penn.* Brit. Zool., ed. iv, vol. iv, p. 95, pl. lv, fig. 51.
— incompta, *Phil.* En. Moll. Sic., vol. i, p. 44, t. iv, fig. 9.
Lucina caduca, *Scac.* Catal., p. 5, fide *Phil.*
Lucinopsis undata, *Forb. & Hanl.* Brit. Moll., vol. i, p. 435, pl. xxviii, figs. 1, 2.
— — *Jeffreys.* Brit. Conch., vol. ii, p. 363, 1863.

Spec. char. L. testa tenui, orbiculato-quadrata, æquilaterali, compressiuscula, lævi, tenuissime et concentricè striata, lunula areaque non distinctis.

Diam. $\frac{1}{2}$ an inch.

Locality. Chillesford bed, Aldeby.

Two small specimens have been found by Messrs. Crowfoot and Dowson, one of which is represented in the above figure.

This species resembles *L. Lajonkairii* in outline and dental characters, but differs in being quite smooth or with only lines of growth without any radiating striæ.

Lucinopsis Lajonkairii, *Payr.* Crag Moll., vol. ii, p. 148, Tab. XI, fig. 14 *a—c.*

This species is very rare in the Red Crag, from which I have never met with more than one specimen, probably derived from the Cor. Crag, where at one time it was somewhat abundant.

This may possibly be referred to *Venus candida*, Gmel., figured by Gualt., 'Test.,' Tab. 75, fig. L, but my shell does not very well accord with those figured by Hörnes and Philippi, which are smaller and much more inequilateral. The representation in the 'Ency. Method.,' pl. 272, fig. 2 *a, b,* corresponds with our Crag shell.

Mr. McAndrew (whose recent death I deeply deplore, and than whom no one has

added more to our knowledge of living European and Atlantic Mollusca) sent me for examination two specimens from the Mediterranean of a shell considered to be identical with this species. These scarcely exceed half an inch in diameter, and if full grown would be much more tumid than my Crag specimens. They were also more coarsely striated or radiated. Under these circumstances I am not satisfied that Lajonkairii is a living species.

CHAMA GRYPHOIDES, *Linné.* Crag Moll., vol. ii, p. 162, Tab. XV, fig. 8.

Localities. As in 'Crag Moll.'

When describing this shell in the 'Crag Moll.' I stated it to be very rare in the Cor. Crag, and it has ever since continued so to my researches. The specimens found by me in the Cor. Crag have always been very small or young individuals, while those from the Red Crag appear all to be full-grown specimens or nearly so. The solidity of the specimens would well protect them in a removal from one formation into another, and I believe, notwithstanding its present scarcity in the Cor. Crag, that the specimens which have been found in the Red Crag of Sutton are extraneous.

In Mr. Jeffrey's List of Red Crag Shells appended to Mr. Prestwich's paper, 'Geol. Journ.,' vol. xxvii, p. 482, this species is given as from Walton, but upon whose authority is not stated. I have never seen it from that locality, but if it be so I should then be more disposed to regard it as a denizen of the Red Crag Sea, and as additional evidence of the greater antiquity of the Walton bed over the rest of the Red Crag.

VERTICORDIA CARDIIFORMIS, *S. Wood.* Crag Moll., vol. ii, p. 150, Tab. XII, fig. 18 (as *Hippagus verticordius*).

Locality. Cor. Crag, Sutton.

Mr. Jeffreys in his list appended to Mr. Prestwich's paper ('Geol. Journ.,' vol. 27, p. 139) has referred this Crag species to what he has called *Pecchiolia acuticostata,* and he has obligingly sent me a single valve for examination. I find this recent shell to differ from the Crag species in being much more tumid and in having the ribs more elevated. In the recent shell these ribs are ornamented with a double row of very fine *spinulæ*, not a trace of which can I discover upon any of my Crag specimens. These may possibly have been rubbed off, but the probabilities are that had they ever existed some trace would remain on one or other of the ribs of the numerous well-preserved Crag specimens that I have examined; but I can detect none. The number of ribs is probably not a reliable character, but while this recent specimen had only fourteen ribs my Crag specimens vary from that number to seventeen. I do not feel justified under these circumstances in adopting the identification of the Crag shell with *acuticostata.* In my 'Eocene Bivalves' (page 138) I have given reasons for recurring to my original generic name of *Verticordia* for the group of Mollusca to which the present shell belongs; and in consequence I have reverted to the specific name of *Cardiiformis,* under which I originally sent it to the 'Min. Con.' in 1844 (Tab. 639).

CARDITA BOREALIS ? *Conrad.* Crag Moll., vol. ii, p. 168, Tab. XV, fig. 6 (as *C. analis ?*).

CARDITA BOREALIS, *Conrad.* Amer. Mar. Conch., 39, pl. viii, fig. 1.

Locality. Chillesford bed, Sudbourn Walks ? Upper Glacial, Bridlington.

This shell, which was described by me under the name *analis*, I know from Bridlington only, but Mr. Bell ('Mag. Nat. Hist.' for 1870) gives it from the Chillesford bed of Sudbourn Church Walks, though I have not seen the specimen. In the 'List of Shells from the Norwich Crag,' by the late Dr. Woodward, the Bridlington shell was referred to *Cardita borealis*, Conrad. The specimens from Bridlington in the British Museum (about twenty-five in number) are much smaller, not measuring more than half an inch in diameter, while the American shell reaches at least an inch, and appears to have a more excentric inclination of the umbo; but, according to Gould, in the young shell the beaks are more central, so that this difference may be due to the Bridlington specimens being all young ones. A shell from Labrador, that seems to be fossil, or semifossil, shown to me by Mr. A. Bell, resembles the Bridlington shell; while a recent specimen of *borealis* from Gaspé, also shown to me by Mr. Bell, appeared to be different from the Bridlington form in being much more transverse. Under these circumstances I have referred the Bridlington shell to the American living species with a doubt, as I am not altogether satisfied on the point.

CARDITA SCALARIS, *Leathes.* Crag Moll., vol. ii, p. 166, Tab. XV, fig. 5.

Localities. Cor. Crag passim. Red Crag, Sutton and Walton. Fluvio-marine Crag, Norwich ? Chillesford bed, Chillesford ? Middle Glacial, Hopton. Living, North-West America ?

This species is exceedingly abundant in the Cor. Crag, and it is not rare in the Red Crag of Suffolk, but many of these latter may be derivatives from the Cor. Crag. One small valve, not quite perfect, was obtained by Mr. Dowson from the Middle Glacial Sands of Hopton and sent to me, and it is given by Dr. Woodward in his Norwich Crag List in White's 'Directory' as from Norwich and Chillesford, but as I have not seen any specimens from either of these places, I have given those localities with a note of interrogation. The species seems to me to survive on the North-West Coast of America, as a shell from there in the British Museum under the name *Cardita ventricosa*, Gould, appears to me to be identical with the Crag form. This species is given as a Bridlington fossil by E. Forbes, 'Mem. Geol. Surv.,' p. 415, 1846, but I have not seen the specimen, and believe it to have been confounded with *borealis* (*analis*). I have not met with it from any of the localities of the Chillesford bed or from the Lower Glacial Sands.

Cardita corbis, *Phil.* Crag Moll., vol. ii, p. 168, Tab. XV, fig. 2 *a, b* (as *Cardita corbis*, var. *nuculina*).

Localities. Cor. Crag, Sutton. Red Crag, Walton. Middle Glacial, Hopton. Living in the Mediterranean.

A single valve is all that has occurred in the Middle Glacial.

Cardita anceps, *S. Wood.* Crag Moll., vol. ii, p. 168, Tab. XV, fig. 2 *c, d* (as *Cardita corbis*, var. *exigua*).

Venerecardria anceps, *S. Wood.* Catalogue, 1840.

Locality. Cor. Crag, Sutton.

In my 'Catalogue' of 1840 I gave this shell under the above specific designation, but in the 'Crag Mollusca' I placed it as a variety of *C. corbis*, under the name of *exigua*, supposing it to be identical with Dujardin's Touraine shell of that name. My further examinations have induced me to revert to my views of 1840, and I have accordingly restored it as a species under the name of *anceps*.

C. corbis (*nuculina*) is the only form that I have seen from the Red Crag, and this is from Walton, where it is not very abundant. *Cardita corbis* is given from the Red Crag at Waldringfield by Mr. Bell and by Mr. Jeffreys, but which of the two forms is referred to I do not know. *Cardita corbis* is the same as the shell now found living in the Mediterranean.

Dujardin represents his *nuculina* as strongly radiated, and the *exigua* as having somewhat oblique transverse ridges, but of the two Crag forms *corbis*, and *anceps*, it is the latter only which is strongly radiated, from which it would seem that *if* the Touraine and Crag shells are identical it is *anceps* which must be referred to *nuculina*, and *corbis* to *exigua*. The shape, however, of the shells would lead to the reverse of this reference, and I am, therefore, very doubtful whether there be any identity between the two Crag and the two Touraine shells. I think, therefore, that I do best and avoid confusion by reverting to my 'Catalogue' name of *anceps* for our present shell, rather than by referring it to either *nuculina* or *exigua*.

Among the synonyms of *C. corbis* I gave *Cardita corbis*, Nyst. This I now believe to be incorrect, the Belgian Crag shell appearing to be different from either of the forms found in the English Crag and to correspond with the Middle Oligocene shell called *Cardita lævigata* by Dr. Speyer ('Mittel. Oligocän. Söllingen,' p. 60, Tab. III, fig. 7). A shell called *Woodia lævigata* by Von Könen ('Mittel. Oligocän.,' p. 108, Tab. VII, fig. 8, *a—d*) is probably the same, but this I have not seen as an English fossil, though

some of the smoother specimens of *anceps* make great approaches to it. Both *corbis* and *anceps* are very abundant in the Coralline Crag.

Cardita senilis, *Lam.* Crag Moll., vol. ii, p. 165, Tab. XV, fig. 1 *a—f.*

Localities. Cor. Crag passim. Red Crag passim except Walton Naze.

The shell which has hitherto gone by the name of *Cardita senilis,* Lam., is one of the most abundant shells in the Coralline Crag, and it is found also in all parts of the Red Crag save Walton, in some, if indeed not all, of which, however, it is probably only present as a derivative. There is some doubt whether this shell be the *Venericardia senilis* of Lam. or the *Cardita rudista* of the same author, under which latter name it is figured by Hörnes, Tab. XXXVI, fig. 2, *a—d,* who associates with it (and I think justly) *Chama rhomboidea,* Broc., Tab. XII, fig. 16. In 'Brit. Conch.,' vol. i, p. xciii, Mr. Jeffreys says, "The *Cardita senilis* of the same beds (Coralline Crag) is the *C. sulcata* of the Mediterranean," and this he has repeated in the list annexed to Mr. Prestwich's Cor. Crag paper. I have, however, carefully compared *sulcata* with the Crag fossil and I cannot coincide in Mr. Jeffreys' opinion. The recent *sulcata* has more rounded ribs, which are nearly smooth, and not imbricated, and the ribs are united at their bases, but in *senilis* they are distant, with a space between them. *Senilis* is exceedingly variable in form, as may be seen by the specimens figured in 'Crag Moll.,' vol. ii, Tab. XV, fig. 1 *a—f,* all of which I believe belong to one and the same species. As so many British authors have referred to this shell for nearly half a century under the name *senilis,* I have not thought it desirable, notwithstanding Dr. Hörnes' identification of it with Lamarck's *rudista,* to make any change in the name.

Cardium fasciatum, *Mont.* Crag Moll., vol. ii, p. 153, Tab. XIII, fig. 4 (as *C. nodosum*).

Localities. Cor. Crag passim. Red Crag passim. Chillesford bed, Aldeby.

The shell figured in 'Crag Moll.,' under the specific name of *nodosum* may probably be *C. fasciatum,* Mont. (*C. elongatum,* Turt.), as has been said by the author of the 'Brit. Conch.' Although a very common shell in the Cor. Crag, the specimens have (with very rare exceptions) the entire surface removed, and with it the tubercular ornament, and in that state it is of very difficult determination. Mr. Crowfoot sent me several small specimens from Aldeby in which parts of the exterior ornament is well preserved, and these may be referred to this species.

Cardium pinnatulum, *Conrad.* Crag Moll., vol. ii, p. 154, Tab. XIII, fig. 3 (as *C. nodosulum*).

Cardium pinnatulum, *Conrad.* Journ. Acad. Nat. Sc., p. 260, pl. xi, fig. 8, 1831.
— — *Gould.* Inv. Mass., p. 90, fig. 57, 1841.

Localities. As in 'Crag Mollusca.'

This in the Crag is rare to my researches. In the 'Crag Mollusca' I thought it to be distinct from *C. pinnatulum*, differing in the number of ribs. I have, however, since seen more of the recent shell, and find that in some specimens they correspond in this respect, so that I have substituted the name of *pinnatulum* for the Crag shell.

Cardium strigilliferum. Crag Moll., vol. ii, p. 154, Tab. XIII, fig. 5.

Localities. Cor. Crag passim.

This Coralline Crag shell is given by Mr. Bell ('Ann. Mag. Nat. Hist.,' 1870) as identical with *C. elegantulum*, Möller, and it is also so referred by Mr. Jeffreys in his list attached to Mr. Prestwich's paper. I have compared my fossil with the recent shell and think that the two are distinct. The Crag shell is more tumid than the recent one, and the tubercles on it are narrow and prominent, being, so to speak, perched on the centre of the rib, while in the recent shell the tubercles are more properly imbrices, and are broad and cover the rib.

Cardium edule, *Linn.* Crag Moll., vol. ii, p. 155, Tab. XIV, fig. 2.

Localities. All the Upper Tertiaries of East Anglia.

This shell first appears in the Cor. Crag, where it is very rare, and it is also rare at Walton-Naze, but it is extremely common in the more recent formations. It is present in the Post-Glacial beds of Kelsey Hill, March, and Hunstanton, also in the Brickearth of the Valley of the Nar.

Cardium nodosum, *Turt.* Supplement, Tab. X, fig. 6.

Cardium nodosum, *Turt.* Brit. Biv., p. 186, t. xiii, fig. 8, 1822.
— — *Jeffreys.* Brit. Conch., vol. xi, p. 283, pl. xxxv, fig. 4.

Locality. Coralline Crag, Sutton.

There are a number of small specimens in my cabinet which I had imagined to be the young of the shell figured in 'Crag Moll.,' Tab. XIII, fig. 4, as C. *nodosum.* This shell, however, has since been referred to *C. fasciatum,* Mont., by Mr. Jeffreys, in which

reference he is probably correct, and I have, therefore, had figured one of my small specimens which seems to correspond with the *nodosum* of Turton. The recent shells called *nodosum* and *fasciatum* being kept separate by conchologists, I have here, in deference, done the same, although, I confess, not without misgivings. Dr. Lovén ('Ind. Moll. Scandin.,' p. 35), when describing *C. fasciatum* and others, says, "Cardia Europæa misere confusa," and I feel disposed to echo his words.

Mr. Jeffreys, in his list to Mr. Prestwich's paper (p. 138), introduces *C. Norvegicum* as a new Cor. Crag species, but no locality is attached to the name; and in his list of Red Crag shells in the same paper (p. 482) *Card. interruptum* is referred to this species (viz. *C. Norvegicum*). If this be the form upon which the name *Norvegicum* is thus introduced as a Coralline Crag species, it will not require another figure; but I have not yet been able to see a shell like *C. interruptum* from the Coralline Crag, or to refer any of my specimens satisfactorily to *C. Norvegicum*.

Cardium Parkinsoni, *J. Sow.* Crag Moll., vol. ii, p. 158, Tab. XIII, fig. 7.

Localities. Red Crag, Walton, Sutton, and Butley.

This species is exceedingly abundant at Walton, but rare in other parts of the Red Crag. Dr. Woodward, in his list in 'White's Directory,' gives it (in fragments) from the Fluvio-marine Crag of Thorpe-by-Norwich, but I have not seen the shell from that Crag, and suspect that the fragments referred to are those of the large individuals of *edule* so common in the Norwich Crag and Lower Glacial sands. *Parkinsoni* much resembles *C. Nuttalli*, Conrad, a shell living in the seas of Upper California ('Journ. Nat. Hist. Soc. Boston,' vol. vii), but I believe our Crag shell to be distinct, as it is less oblique, with fewer and broader ribs, and these are united at their bases, while the ribs in *Nuttalli* have a distinct space between them. In both species the ribs are imbricated.

Cardium decorticatum, *S. Wood.* Crag Moll., vol. ii, p. 159, Tab. XIV, fig. 1.

Localities. Cor. Crag passim.

This is abundant in a fragmentary state in the Cor. Crag, but perfect specimens are difficult to obtain; it was a handsome shell, and fragments indicate a length of $3\frac{1}{2}$ inches. *C. venustum* resembles it, and may possibly be the same species; but, as I have before stated, it is a smaller shell and smoother, the ribs in *decorticatum* being prominent and distinct. In the list annexed to Mr. Prestwich's Cor. Crag paper this shell is referred to *C. lævigatum*, Poli, but in the list to the Red Crag paper it is referred to *C. Norvegicum*. I cannot, however, agree in either reference; and have not seen it from the Red Crag, but only the allied form *venustum*.

CARDIUM ISLANDICUM, *Linn.*

Localities. Middle Glacial, Hopton? Upper Glacial, Bridlington?

This species is given by Dr. Woodward in his list of Bridlington fossils ('Geol. Mag.,' vol. i, p. 54), but the specimen in the British Museum, upon the authority of which this was done, is too imperfect to be referred with certainty to any species. Umbonal portions of a large *Cardium* similar to the Bridlington species occur in the Middle Glacial sands of Hopton. These, so far as such fragments are reliable, may possibly belong to *C. Islandicum*, or as likely to *C. decorticatum*, and from this uncertainty I have not thought it desirable to figure these fragments.

ERYCINELLA OVALIS, *Conrad.* Crag Moll., vol. ii, p. 171, Tab. XV, fig. 10.

Localities. Cor. Crag passim. Red Crag, Walton (*A. Bell*). Middle Glacial, Hopton.

In assigning the above name to the (once) common Cor. Crag shell I was, as explained in the 'Crag Mollusca,' guided by the report on it kindly brought home for me from Mr. Conrad by Sir Charles Lyell. I have some misgivings about the identity, not having been able to see the American fossil, and if it should hereafter prove to be distinct the specific name of *pygmæa* assigned to it in my Catalogue ('Ann. and Mag. Nat. Hist.,' Dec., 1840) will be applicable to it.

It is singular that, though once very common in the Cor. Crag at Sutton, I have not been able to find a specimen for many years, though I have sifted tons of the Cor. Crag material from the identical spot and horizon at Sutton where I once found it common. Mr. Bell ('Ann. and Mag. Nat. Hist.,' Sept., 1870) gives the species from the Red Crag, Walton, but I have not seen the specimen. Five valves in fair preservation have occurred in the Middle Glacial of Hopton.

CORALLIOPHAGA CYPRINOIDES. Crag Moll., vol. ii, p. 200, Tab. XV, fig. 7 *a—d.*

Locality. Cor. Crag, Sutton and Ramsholt.

My specimens of this are still very rare and very small. It may possibly be the same as *Chama lithophagella*, Broc., which is said to be a common living shell in the Mediterranean, but in the uncertainty I do not think it is necessary to alter the name I had previously given. It cannot be referred to *lithophagella*, Lam. (*Cypricardia*), an externally ornamented West Indian species; my shell is quite smooth.

Astarte borealis, *Chemn.* Crag Moll., vol. ii, p. 175, Tab. XVI, fig. 3 *a, b.*

Localities. Fluvio-marine Crag, Bramerton, Thorpe, and Postwick. Chillesford bed, Aldeby, Bramerton, Horstead, and Coltishall. Lower Glacial, Weybourn, Belaugh, and Rackheath. Middle Glacial, Hopton. Upper Glacial, Bridlington. Post Glacial, March.

This is one of the very few shells of the Fluvio-marine Crag, that on the assumption of their being coeval deposits, might have been expected to occur also in the Red, but which have not yet been found in it. Although present in the Fluvio-marine Crag at Bramerton, I am informed that it is rare, while in the Chillesford bed exposed in the same deep section at Bramerton it is common. It occurs in the Chillesford bed at most of the localities except at Chillesford, at which place I have not heard of its occurrence; and it has been found in the Lower Glacial Sands at Belaugh, Rackheath, and Weybourn, the base of those sands at the first of these places being literally a pavement of detached valves of this shell. It is not uncommon at Hopton in a fragmentary state, but only one perfect valve has occurred there. The specimens from March are somewhat peculiar, having fine striations, so that it was inserted by Mr. Seeley in his list of shells in the 'Quart. Journ. Geol. Soc.,' vol. 22, p. 473, as *A. crebricostata.* The March specimens, however, have not the denticulated margin of *crebricostata,* and some of the specimens exceed in magnitude any of *crebricostata* that I have seen. The form called *Withami* (fig. 3 *c—d*) appears to be confined to the Bridlington locality, where it occurs in association with the typical form of *borealis,* and, so far as shape is concerned, seems to bear the same relation to it that *A. elliptica* bears to *A. sulcata;* but there is not the difference of a notched margin such as obtains between *elliptica* and *sulcata.*

Astarte Burtinii, *La Jonk.* Crag Moll., vol. ii, p. 188, Tab. XVII, fig. 5 *a—d.*

Localities. Cor. Crag passim. Red Crag, Sutton. Fluvio-marine Crag, Bramerton? Middle Glacial, Hopton.

This shell still remains to me very rare in the Red Crag. It is given by Dr. Woodward in his list in 'White's Directory' as in the Norwich Crag, on the authority of a single valve said to have been found there by Mr. Wigham; but I have not been able to hear of its occurrence there from other sources, and its presence in the Fluvio-marine Crag must be received with doubt. I have not met with it from the Lower Glacial sand or from any of the localities of the Chillesford bed. In the Middle Glacial sands of Hopton several young specimens have occured, but all, except one of them, imperfect. I have not met with it from any newer Glacial or from any Post Glacial bed, nor do I know it as living.

ASTARTE COMPRESSA, *Mont.* Crag Moll., vol. ii, p. 183, Tab. XVI, fig. 8 *a—c*.

Localities. Red Crag passim. Fluvio-marine Crag, Bramerton and Thorpe. Chillesford bed, Bramerton, Horstead, Colteshall, and Aldeby. Lower Glacial, Belaugh and Weybourn. Middle Glacial, Billockby and Hopton. Upper Glacial, Bridlington. Post Glacial, Kelsea Hill?

The occurrence of this shell from its first appearance in the oldest part of the Red Crag to the top of the Glacial series seems very uniform. It is particularly common in the Middle Glacial sands of Hopton, where, although almost always more or less worn, the valves of it occur perfect far more frequently than do those of any other bivalve. Mr. Jeffreys ('Quart. Journ. Geol. Soc.,' vol. xvii, p. 448) gives a fragment of it from the Kelsea Hill gravel, which is the only instance of its occurrence known to me in the Post Glacial deposits of East Anglia.

ASTARTE GALEOTTII? *Nyst.* Crag Moll., vol. ii, p. 185, Tab. XVII, fig. 3 (as *A. gracilis*).

In the list by Mr. Jeffreys ('Geol. Journ.,' vol. xxvii, p. 138) this Crag shell is considered merely as a var. of *A. compressa,* from which opinion I dissent, believing the two to be specifically distinct; the Cor. Crag shell is not only different in form, but when full grown it has a denticulated margin which is absent from *compressa* in all stages of its existence.

Mr. A. Bell ('Ann. and Mag. Nat. Hist.,' May, 1871) pointed out that *A. gracilis,* so called by me, was not, according to Dr. Weichman, the same species as *A. gracilis,* Munst., adding that the Cor. Crag shell must be referred to *A. Galeotti,* Nyst., which name I had given as a synonym. Dr. Weichman has obligingly sent some of his German specimens for examination, and I find that they are quite distinct. The shell called *Galeotti* by Nyst certainly comes near to one of the varieties of my Crag species (fig. 3 *d*), but that is not the general form. A shell also like this from Thorigny (in the Faluns), given to me by Sir Charles Lyell, equally resembles our small variety, but it does not seem ever to have attained so great a magnitude. Under these circumstances I have given the shell under the name *Galeotti* with a doubt.

ASTARTE INCRASSATA, *Brocchi.* Crag. Moll., vol. ii, p. 178, Tab. XVI, fig. 6 *a, b*.

Localities. Cor. Crag passim. Red Crag, Sutton. Middle Glacial, Hopton?

This species is in Mr. Jeffreys' list just referred to and in the 'Brit. Conch.'

regarded as a variety of *A. sulcata,* the ridged or sulcated form being the British and Arctic one, and the smooth form the Mediterranean one. It appears to me, however, that where such distinct forms are characteristic of separate areas it is but a question of words whether for palæontological purposes we call them species or varieties, and it is significant that in the Cor. Crag, with, as I consider, a fauna having its chief affinities with the Mediterranean, we get no trace of *sulcata,* but have *incrassata* in profusion. Some imperfect specimens have occurred in the Middle Glacial at Hopton that seem to belong to this species, but being imperfect I have assigned a Middle Glacial locality to it with a note of interrogation. If, however, better specimens should confirm this, we should, as the undoubted *sulcata* occurs at Hopton, have both the Arctic and Mediterranean forms together in the Middle Glacial deposit. This is probably *Tellina fusca,* Poli.

Astarte sulcata, *Dacosta.* Crag Moll., vol. ii, p. 182, Tab. XVI, fig. 5 *a, b.*

Localities. Red Crag, Sutton. Fluvio-marine Crag, Bramerton and Thorpe? Chillesford bed, Aldeby. Middle Glacial, Hopton. Upper Glacial, Bridlington. Post Glacial, March.

This shell still remains in the Red Crag very rare to my researches. It is given by Dr. Woodward in his Norwich Crag list as occurring both at Bramerton and Thorpe, the young being more frequent, but I have not been able to confirm this through any of my Norwich correspondents. It has been obtained at Aldeby by Messrs. Crowfoot and Dowson. In the Middle Glacial at Hopton two or three perfect valves of young specimens and one full grown have occurred. It is among the specimens in the British Museum from Bridlington, and Mr. Harmer has found it at March.

Astarte Omalii, *La Jonk.* Crag Moll., vol. ii, p. 180, Tab. XVII, fig. 1 *a—f.*

Localities. Cor. Crag passim. Red Crag, Sutton. Fluvio-marine, Bramerton? Middle Glacial, Hopton.

The principal portion of a shell, as well as some other fragments, which have occurred at Hopton, enable me to refer this species to the Middle Glacial sands without much hesitation. It is given in Dr. Woodward's list as from Bramerton, but I have not been able to obtain confirmation of this, and have placed a note of interrogation to that locality.

This species is referred by Mr. Jeffreys in his list to *A. undulata,* Gould, but its identity with that shell I fully considered more than twenty years ago, and the reasons for keeping the two species distinct, given by me at p. 180, vol. ii, of 'Crag Mollusca,' appear to me to be still valid. If we were to strain identities in this way a suite of

various acknowledged species of this variable genus might be so selected as all to run into one another and the whole of such species accordingly merged in one. In a genus such as this, wherein the specific forms thus graduate into one another, and which, moreover, goes back far into the Mezozoic formations with but little departure from the living types, a more arbitrary line of specific division should be allowed than in the case of species of less variable genera.

Astarte Forbesii, *S. Wood.* Crag Moll., vol. ii, p. 192, Tab. XVII, fig. 12 *a, b* (as *A. parva*).

Localities. Cor. Crag passim.

When describing this shell I was not aware that the name of *parva* had been given to another species in this genus; but I find that a fossil, which is quite distinct, has been so called by Dr. Lea ('Contrib. to Geol.,' p. 63, pl. 2, fig. 37), and as this is of prior date (1833), my name, of course, must be suppressed.

In a catalogue of the Mediterranean Mollusca by Mr. Jeffreys, published in the 'Ann. and Mag. Nat. Hist.,' July, 1870, is the name *Astarte parva*, S. Wood; and that gentleman there says, "This may possibly be *A. pusilla* of Forbes; the inside margin is notched in my specimens;" and in the list by the same gentleman accompanying Mr. Prestwich's Cor. Crag paper this identification is inserted without any qualification. I have endeavoured to find out the type-specimens of Forbes' species, but unsuccessfully. It is, however, described by Forbes as "concentricé striata, margine interno denticulato;" but as the markings on my shell are eccentric instead of concentric, and the margin free from denticulations, no greater discordance, so far as description goes, could well occur. In general, where the *full-grown* shell of *Astarte* has a denticulated margin, the *young* has this margin smooth, and as I have now before me one hundred specimens of this Crag species, not one of which has a denticulated margin, I can hardly suppose them all to be immature shells; I therefore cannot with any propriety refer the Crag shell to *pusilla.* It much resembles an Oligocene fossil named and described by Dr. Speyer as *Goodallia Köneni* ('Die. Ober. Oligoc. Test. Detmold,' tab. iv, fig. 6, 1866), which is ornamented with oblique ridges and has a smooth margin, but, judging from the representation, it is not a satisfactory identification; therefore, until specimens can be compared, and as the name *parva* must be abandoned, I have assigned to my shell the name *Forbesii.*

The late Mr. McAndrew gave me some specimens of a small *Astarte* which he obtained in the living state off the Canaries, that much resembles the Cor. Crag shell called *A. parvula;* but I think the recent shell specifically different; it is rather less oblique, the lateral denticles of the recent shell are shorter, and the ventral margin is denticulated. I have also a fossil specimen from Cannes, which is more shaped like Mr. McAndrew's shell, but it has a smooth ventral margin. The following from the Upper Tertiaries of East Anglia I consider as distinct species:

Crenulated in the mature state.	Not crenulated at any stage of growth.
Astarte Basterotii.	Astarte borealis.
„ Burtinii.	„ compressa.
„ crebricostata.	„ elliptica.
„ crebrilirata.	„ Forbesii.
„ incrassata.	„ parvula.
„ Galeottii.	
„ mutabilis.	
„ obliquata.	
„ pygmæa.	
„ Omalii.	
„ sulcata.	
„ triangularis.	

The different formations to which these species belong will be found in my Compendium or General Table.

WOODIA DIGITARIA. Crag Moll., vol. ii, p. 190, Tab. XVII, fig. 8 (as *Astarte digitaria*); Supplement, Tab. X, fig. 8 *a*.

Localities. Coralline Crag passim. Red Crag, Walton, Bentley, and Butley (*Bell*). Middle Glacial, Hopton.

Var. *Hoptonensis,* Supplement, Tab. X, fig. 8 *b*.

Locality. Middle Glacial, Hopton.

The small shell represented in 'Supplement,' Tab. X, fig. 8 *b*, is from the Middle Glacial sand of Hopton, and as it seems to differ materially from the Coralline and Red Crag specimens I think it deserving of a separate figure. This Middle Glacial shell is much less transverse than any of my specimens from either the Coralline[1] or Red Crags, and the elliptical markings much more distant, being scarcely half so numerous as in the Cor. Crag specimens. I have found specimens of the same species at Walton Naze and they are of an intermediate form, with the elliptical lines more distant than those upon the Cor. Crag specimens, but not so much so as upon the Glacial one, while the form of all the Red Crag specimens is generally even more transverse than the Coralline Crag ones.

I had another figure ('Supplement,' Tab. X, fig. 8 *a*) made of the Cor. Crag shell in order to show the ornamentation on the posterior side of the shell, which is not distinctly shown in the figures in Tab. XVII, but the artist has not been fortunate in his representation. These are transverse to the sulcations and form ridges upon them. They

[1] Since the above was in type I have found in the Coralline Crag a specimen presenting the elliptical markings nearly as distinct as in the Hopton specimen. This, however, is the only example presenting that feature which I have met with among the very numerous Coralline Crag specimens of this species that have passed through my hands.

are but very faintly perceptible in the Red Crag specimens and not at all in the Glacial one; possibly in both this may be due to wear. One other valve, which is imperfect and which more agrees with the typical form, is all that I have met with from the Middle Glacial sands.

Astarte excurrens ('Crag Moll.,' vol. ii, p. 191, Tab. XVII, fig. 9) seems more probably to belong to the genus *Woodia* than to *Astarte*, and I have so placed it in the tabular list.

CYPRINA ISLANDICA. Crag Moll., vol. ii, p. 196, Tab. XVIII, fig. 2.

Localities. Cor. Crag, passim. Red and Fluvio-marine Crags, and Chillesford bed, passim. Lower Glacial, Rackheath, Belaugh, and Weybourne. Middle Glacial, Billockby, Hopton, and Wisset. Upper Glacial, Bridlington, and Dimlington. Post-glacial, March and Kelsea Hill.

This shell is very common in some localities of the Coralline Crag; plentiful in the Red Crag, though seldom perfect; common in the Fluvio-marine Crag and Chillesford beds at all localities, as well as in the Lower Glacial sands of Belaugh, Rackheath, and Weybourne, and in the Middle Glacial sands of Hopton and Billockby. It occurs in the gravel of this deposit also at Wisset (north-west of Halesworth). It is common in the March gravel, and a fragment is mentioned by Mr. Jeffreys at Kelsea Hill. It is the universal shell of nearly all the Upper Tertiaries of East Anglia, but does not appear to have occurred in the Nar Brickearth.

CYPRINA RUSTICA, *J. Sow.* Crag Moll., vol. ii, p. 197, Tab. XVIII, fig. 1.

This was at one time abundant in the Cor. Crag at Ramsholt and also near Orford, and I have found it, though rarely, in the Red Crag at Sutton, where probably it may have been a derived shell. The late Mr. Rose informed me that he had found it in the sand of Bradwell (Middle Glacial), but the fragment in his collection to which this name was attached appeared to me to be an imperfect specimen of some species of *Cardium*, with its surface eroded.

CYTHEREA RUDIS, *Poli.* Crag Moll., vol. ii, p. 208, Tab. XX, fig. 5 *a—d.*

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Norwich? Middle Glacial, Hopton.

In his list in 'White's Directory' Dr. Woodward gives this shell from the Norwich Crag on the authority of a single valve in Mr. Wigham's collection. I have not been able to learn from other sources of its occurrence in that Crag, and have, therefore, placed a note of interrogation to it. In the Middle Glacial sands of Hopton there have occurred many imperfect specimens, composed of the hinge and umbonal region, that seem referable to this species.

Venus fasciata, Crag Moll., vol. ii, p. 211, Tab. XIX, fig. 5.

Localities. Red Crag, Sutton and Walton. Fluvio-marine Crag, Bramerton. Middle Glacial, Billockby and Hopton.

This shell is somewhat rare both in the Red and Fluvio-marine Crags, and I have not met with it from any of the localities of the Chillesford bed or from the Lower Glacial sands. In the Middle Glacial, both at Hopton and at Billockby, it is in extraordinary profusion, but mostly in a fragmentary condition, the hinges being extremely abundant. Very few perfect specimens, and those only of young individuals, have occurred.

Venus ovata. Crag Moll., vol. ii, p. 213, Tab. XIX, fig. 4.

Localities. Cor. Crag passim. Red Crag, Sutton, Butley. Chillesford Bed, Aldeby. Middle Glacial, Billockby and Hopton.

This shell, so profuse in the Cor. Crag, is exceedingly rare in the Red and does not appear to have been met with at all in the Fluvio-marine Crag, but it has been found in the Chillesford bed at Aldeby by Messrs. Crowfoot and Dowson. I have not seen it from the Lower Glacial sands, but it is common, though usually in a fragmentary condition, in the Middle Glacial of Hopton and Billockby, only very young specimens occurring perfect.

Venus verrucosa, *Linn.*

This, in 'Brit. Conch.,' vol. ii, p. 341, is given as a "Cor. Crag species" (S. Wood), but in vol. v, p. 184, it is said "not Coralline Crag." I have not seen it, however, from any of the Tertiaries of East Anglia. It is, I believe, not rare in the Post-glacial deposit at Selsey in Sussex, and it is present, also, in the Clyde beds and Belfast deposit.

VENUS FLUCTUOSA, *Gould*. Supplement, Tab. IX, fig. 8.

VENUS FLUCTUOSA, *Gould*. Invert. Massach., p. 87, fig. 50, 1841.
— — *Dekay*. Nat. Hist. New York (Zool.), p. 222, 1843.
— — *S. P. Woodward*. Geol. Mag., vol. i, p. 54, 1864.
TAPES — *Binney*. 2nd edit. Gould's Inv. Mass., p. 136, fig. 447.

Spec. char. "Shell moderately small, transversely ovate, lenticular, rather thin. Surface with 20—25 recurved concentrated waves, vanishing at the side; areola none. Middle tooth in each valve cleft. Epidermis thin, glossy, yellowish, beneath this white. Length 0·8; breadth 0·22."

Localities. Middle Glacial, Hopton. Upper Glacial, Bridlington. Recent, Newfoundland and Greenland.

The specimen figured was obtained from the Middle Glacial sand of Hopton Cliff by Mr. Dowson, and it is the only one in fair preservation that has occurred there; but small specimens somewhat worn, and portions of shells more or less worn, are not uncommon at that locality. This shell has also occurred in the Bridlington bed, but I do not know it from any other formations in Europe than that and the Middle Glacial of East Anglia.

VENUS GALLINA, *Linné*. Supplement, Tab. X, fig. 23.

VENUS GALLINA, *Linn*. Syst. Nat., edit. xii, p. 1130.
— — *Phil*. En. Moll. Sic., vol. i, pp. 46, 48.
— — *Jeffreys*. Brit. Conch., vol. ii, p. 344, var. *gibba?*

Locality. Post Glacial, Kelsey Hill.

In Mr. Prestwich's paper on the Kelsey Hill deposit ('Geol. Journ.,' vol. xvii) is a list of the shells by Mr. Jeffreys, among which is the name of *Venus striatula,* "a single valve," and this specimen Mr. Prestwich has obligingly permitted me to have the use of for the above illustration.

This is of the more rounded form, corresponding in that respect with the Mediterranean form of the species, and it has not the projecting termination on the siphonal side like the British variety. It much resembles the figure in the 'Ency. Meth.,' pl. 286, fig. 3, only that in our shell the concentric ridges are more distant. This may probably be referred to the variety called by Mr. Jeffreys *gibba,* though our shell is not very tumid. Philippi gives this species as recent from the Mediterranean and fossil from the Sicilian beds.

This Kelsey Hill shell has, like the shells of that deposit in general, a very recent aspect, appearing to have retained much of its animal matter. There are vestiges of a finely crenulated margin which it once possessed, but the specimen has been slightly waterworn. I have not met with it from any older deposit in East Anglia, although the name of *Venus gallina* is in the list of shells from Harwich by Mr. Webster before spoken of. As this reference of Mr. Webster's has so long remained unconfirmed he possibly mistook for the present species some specimens of *V. imbricata.*

Tapes pullastra, *Montague.* Supplement, Tab. IX, fig. 1 *a—b.*

Venus pullastra, *Mont.* Test. Brit., p. 125.
Tapes — *Forb. and Hanl.* Brit. Moll., vol. i, p. 382, pl. xxv, fig. 23.
— — *Jeffreys.* Brit. Conch., vol. ii, p. 355, pl. xxxix, fig. 6.

Localities. Red Crag, Walton? Waldringfield. Middle Glacial, Hopton and Billockby?

The smaller figure represents a perfect specimen (now in the Brit. Mus.) obtained by Mr. Charlesworth from Waldringfield; this is located in a mass of indurated clay. The larger specimen, fig. 1 *a*, was found by myself at Walton, and, I think, belongs to the same species, but the outer surface is gone, either by decortication or abrasion, so that I am not able to tell from its form whether it belongs to this species or to *decussatus.* I have also found an imperfect specimen in the Cor. Crag (almost a facsimile of the specimen figured 1 *a*) with the exterior surface removed. The hinges of either this species or of *virgineus* (or probably of both) are abundant in the Middle Glacial sand of Billockby and Hopton.

Tapes aureus, *Gmel.* Crag Moll., vol. ii, p. 202, Tab. XX, fig. 2.

Locality. Fluvio-marine Crag, Bramerton.

This species is, I am informed, abundant near Norwich, but I have not seen it from either the Coralline or the Red Crag. It is, therefore, one of the two or three species occurring in the Fluvio-marine Crag that, having regard to the conditions of the Red Crag deposit, we should have expected to have occurred also in that Crag, on the assumption of its being coeval with the Fluvio-marine.

Tapes decussatus, *Linn.* Supplement, Tab. X, fig. 4.

Venus decussata, *Linn.* Syst. Natur., p. 1135.

Localities. Post Glacial, Nar Brickearth, Pentney and Bilney.

The specimen figured is from the late Mr. Rose's Nar Brickearth collection, and this

deposit is the only one among the Upper Tertiaries of the East of England in which it has for certainty occurred. It is, I believe, abundant in the deposit at Selsey, and in that near Belfast, and in the Clyde beds.

VENERUPIS IRUS, *Linn.* Crag Moll., vol. ii, p. 205, Tab. XIX, fig. 6 *a—b*.

Localities. Cor. Crag, Sutton. Red Crag, Walton.

I have recently found a fragment of this shell in the Cor. Crag of Sutton, having known it previously only from the Red Crag of Walton. *Venerupis Irus* so much resembles the genus *Tapes* in every respect that I believe it belongs to the *Veneridæ* and not to the *Saxicavidæ*.

GASTRANA LAMINOSA, *J. Sow.* Crag. Moll., vol. ii, p. 217, Tab. XXV, fig. 1.

Localities. As in 'Crag. Moll.'

This is (or was) not very rare either in the Cor. Crag of Orford and Sutton or in the Red Crag at Walton Naze and Sutton, but I do not know whether it extended its existence into the Butley Crag. The South African shell, called *Petricola ventricosa,* Krauss, 'Sud. Afrikan. Mollusk,' very much resembles our species, and seems to be its representative in the southern hemisphere in the same manner as many Australian marine shells are said to be identical with those in Europe. *Tellina Guinaca,* Chemn., vol. x, p. 346, tab. 170, figs. 1651-3, a species from Tranquebar, is another shell that can scarcely be removed from our Crag species. *Gastrana laminosa* is given as *Fragilia laminosa* by Mr. Jeffreys in his list accompanying Mr. Prestwich's Cor. Crag paper, p. 139.

DONAX VITTATUS, *Da Costa.* Crag Moll., vol. ii, p. 219, Tab. XXII, fig. 7.

Localities. Fluvio-marine Crag, Bulchamp, Postwick, and Bramerton? Chillesford bed, Horsted and Aldeby. Lower Glacial, Belaugh.

In the 'Crag Mollusca' this shell is given from the Crag of Bramerton, but Mr. Reeve does not appear to have detected it there. It is, however, given by the late Dr. Woodward in his list in White's 'Directory' as from Bulchamp and Postwick as well as Bramerton. If it be thus present in the Fluvio-marine Crag it is another of the few shells that, on the hypothesis of the Red and Fluvio-marine Crags being coeval, ought to occur in the Red Crag, but which has not yet been detected there. I have found this species myself at Horsted and Belaugh, and it was sent to me from Aldeby by Messrs. Dowson and Crowfoot.

DONAX POLITUS, *Poli.* Crag Moll., vol. ii, p. 220, Tab. XXII, fig. 9.

Localities. Cor. Crag, Sutton and Gedgrave. Red Crag, Walton (*A. Bell*), and Sutton.

Mr. Bell gives this shell ('Ann and Mag. Nat. Hist.,' 1871) from the Red Crag of Walton and Sutton, and I have myself a specimen from the latter locality. At the time of the publication of the 'Crag Mollusca' I had only seen it from the Cor. Crag.

PSAMMOBIA COSTULATA, *Turton.* Supplement Tab. X, fig. 7.

PSAMMOBIA COSTULATA, *Turt.* Conch. Dith., p. 87, tab. vi, fig. 8.

Locality. Coralline Crag, Sutton.

In 'Brit. Conch.,' vol. ii, p. 395, the author says, "I observed a specimen (of this species) in Mr. Searles Wood's collection in the Brit. Museum." I have here had the specimen in question figured, and the radiating lines, similar to those which distinguish the recent *costulata*, are very apparent; but the form of the fossil does not accurately agree with that of the recent shell, and I am not satisfied that it is the same species. Should further specimens turn up which present the same difference in form from the recent shell, I should propose for the Crag shell the name *pseudo-costulata.*

PSAMMOBIA TELLINELLA. Crag Moll., vol. ii, p. 223, Tab. XXII, fig. 4.

Locality. Cor. Crag, Sutton.

Perfect specimens of this shell are very rare with me, but I have met with fragments indicating a length of more than an inch, which seems somewhat to exceed that of the British shell of this name, and it is rather more elongated and less tumid. It appears to me more to resemble the Touraine shell called *Psam. affinis*, Dujardin ('Mém. Géol. Soc. Fr.,' tom. ii, pt. ii, p. 257, Pl. XXVIII, fig. 4), but I have not been able to obtain a specimen of that fossil for comparison, and I have left it for the present with its original name. I have seen the Crag shell only from the Cor. Crag of Sutton.

SOLECURTUS STRIGILLATUS, *Linné.* Crag Moll., vol. ii, p. 252, Tab. XXV, fig. 3 (as *Macha strigillata*).

Localities. Cor. Crag, Sutton.

This Mediterranean shell is regarded as distinct from the British one called *candidus*, but I can discover no difference between them except in size and colour, and as stated in

the 'Crag Mollusca,' remains of colour in the Crag specimens (which are fragmentary) induced me to refer them to the Mediterranean form. I was misled by Herrmannsen (who gave the date of the name *Macha* as of 1815 instead of 1835) in using that generic name for this shell. *Solecurtus antiquatus* is mentioned in 'Brit. Conch.,' vol. iii, p. 7, and by the author of that work in his list to Mr. Prestwich's Cor. Crag paper, as a Coralline Crag shell; while Mr. Bell, in his paper on the "English Crags" ('Proc. Geol. Association,' 1872) inserts it as a Red Crag species. The only specimens, however (which are all fragmentary), that I have seen from any part of the English Crag belong either to *strigillatus* or *candidus*.

Much difficulty seems still to exist respecting the siphonal side of shells of this family. In 'Brit. Moll.,' vol. i, Pl. I, as I before pointed out ('Crag Moll.,' vol. ii, p. 254), the illustrations for this genus, as well as for other genera in the same plate, show the foot protruded on the siphonal or ligamental side of the shell, and the same misrepresentation is repeated in the generic illustrations in Pl. I, vol. iii, of 'Brit. Conch.' The sinuated mark in the interior of a bivalve, when it exists (as left by the impression of the retractor muscles), is on the side which bears the ligament, and *the siphons* are protruded in that direction, the foot going in the opposite.

CULTELLUS SUTTONENSIS, *S. Wood.* Supplement, Tab. X, fig. 15.

Spec. char. *C. Testa transversa, oblongo-lineari, rectiuscula, lævigata, tenuis, fragilis, antice breviore, rotundato-truncata, postice longiore et latiore; valdè inæqui-lateralis, in valvula dextra bidentatis, in valvula sinistra tridentatis.*

Length $\frac{6}{8}$ of an inch.

Locality. Cor. Crag, Sutton.

Some fragments of this shell have been long in my cabinet, and I had imagined them to belong to the same species as that from the Red Crag of Walton, which I had in the 'Crag Mollusca' figured under the name of *tenuis*, Phil. I now believe these to be specifically different, and a perfect specimen having been obtained by Mr. Robert Bell, I have figured it as above. The shell differs from *pellucida* in the absence of curvature and the broadness of the posterior extremity; it differs also from the Upper Eocene species, *C. Grignonensis*, Desh. ('An. sans. vert. du Bas. de Par.,' Tom. 1, p. 157, Pl. VII, figs. 13—15) in its outline, that shell approaching nearer to *pellucidus* than does our own shell. A fragment in my possession indicates a length of more than three fourths of an inch.

A specimen of *Cultellus* from the Aldeby bed sent me by Messrs. Crowfoot and Dowson is represented in Tab. X, fig. 14. This seems to be intermediate between the Cor. Crag form *Suttonensis* and the recent form *pellucidus*, as the formation from which it comes is correspondently intermediate in time. It is therefore not unlikely that

Suttonensis was the antitype from which the recent *pellucidus* has descended through such modifications as are exhibited in the Aldeby specimen. I have had the recent shell figured beneath these two (Tab. X, fig. 16) for comparison with them.

CULTELLUS CULTELLATUS, *S. Wood.* Crag Moll., vol. ii, p. 258, Tab. XXV, fig. 2 (as *C. tenuis,* Phil.)

CULTELLUS CULTELLATUS, *S. Wood.* Catalogue, Ann. & Mag. Nat. Hist., 1840, p. 245.

Locality. Red Crag, Walton Naze.

In the 'Crag Mollusca' I referred some fragments of a *cultellus* from the Coralline Crag and some perfect valves from the Walton Red Crag to Philippi's species *tenuis.* This I now believe to have been an error. The Red Crag specimens, which are perfect, enable me to refer them to a new species under the name *cultellatus,* which is the name I proposed for both the Coralline and Red Crag forms in my catalogue of 1840.

With respect to the fragments from the Coralline Crag, however, they are insufficient for any satisfactory determination, and may probably be fragments of the before-described *Suttonensis.*

If either *cultellatus* or *Suttonensis* were regarded as identical with *pellucidus,* then most assuredly the Eocene species, *Grignonensis* and *affinis,* would have to be treated as identical also, for the differences between *Suttonensis* and *Grignonensis,* and between *cultellus* and *affinis,* are less than between the Crag shell and *pellucidus.*

In 'Brit. Conch.,' vol. iii, p. 15, *Solen pellucidus* is said to be a Coralline Crag species, but in the list to Mr. Prestwich's Cor. Crag paper *Cultellus tenuis* is mentioned, and not *pellucidus,* while in the Red Crag list *Solen pellucidus* is given as a species from Aldeby.

SOLEN SILIQUA, *Linn.* Crag Moll., vol. ii, p. 255, Tab. XXV, fig. 7.

Localities. Red Crag, Sutton. Fluvio-marine Crag, Bramerton. Chillesford bed, Aldeby? Middle Glacial, Hopton?

This is the only species yet known from the Fluvio-marine Crag in which it is rare. Fragments of a *Solen* have occurred at Aldeby and at Hopton, but neither of them sufficiently characteristic to permit a certain reference to this species. I have therefore given it from the Chillesford Bed and from the Middle Glacial sand with doubt. The species is still unknown to me from the Coralline Crag.

Tellina pulchella ? *Lamarck*. Supplement, Tab. X, fig. 5.

Locality. Cor. Crag, Sutton.

An imperfect valve belonging to the genus *Tellina* was found by myself as above, and it had for some time been in my cabinet. This specimen, which is the right valve, has only the anterior portion remaining, the siphonal side of the shell, which would best assist in its determination, being unfortunately wanting. My specimen, however, shows that the hinge possessed two cardinal teeth, one single and the other bifid, and one elongated *lateral* tooth on the broader or anterior side resembling in its dental formula the hinge of *Tellina donacina*, but the present specimen is much larger than any specimen of that species that I have seen, and it is also a flatter shell; like it, however, it is covered with broad and distinct striæ or lines of growth. I have given it provisionally the above name. Since the specimen was engraved, and while in the hands of the engraver, it has, I regret to say, been destroyed.

Tellina compressa, *Broc.* Crag Moll., vol. ii, p. 234, Tab. XXII, fig. 6 (as *T. donacella*).

Locality. Cor. Crag, Sutton.

This is an exceedingly rare shell to my researches. In the 'Crag Moll.' I observed that this might probably be referred to *T. compressa*, Broc., of which a very bad representation is given in 'Conch. Foss. Subap.,' Pl. XII, fig. 9. It is the same as *T. distorta*, Dubois, 'Volh. Pod.,' Tab. V, figs. 3, 4. Mr. Jeffreys has obligingly sent me some recent specimens from the Coast of Portugal with the name of *Tellina compressa*, Broc., for comparison, and these correspond with my Crag shell.

Tellina fabula, *Gronov.* Crag Moll., vol. ii, p. 232, Tab. XXI, fig. 3.

Localities. Fluvio-marine Crag, Bramerton and Bulchamp. Chillesford bed, Aldeby and Horstead.

In the 'Crag Moll.' this shell was figured from a recent specimen, the only Crag one then known having been lost. A specimen has lately been obtained from the Fluvio-marine Crag at Bramerton by Mr. Reeve; one was sent to me from Aldeby by Messrs. Crowfoot and Dowson, and two were obtained by myself from Horstead.

Tellina Balthica, *Linné*. Crag Moll., vol. ii, p. 231, Tab. XXII, fig. 1.

Localities. Lower Glacial, Weybourne, Belaugh; Rackheath, Crostwick, Spixworth, and Wroxham. Middle Glacial, Hopton, Billockby and Clippesby. Upper Glacial, Bridlington and Dimlington. Post Glacial, March, Kelsea Hill, Paull Cliff, Hunstanton, and Nar Brickearth.

This shell was erroneously given by me from Bramerton, where it has never occurred. The Weybourne locality for it referred to the Mammaliferous Crag in the 'Crag Mollusca' is the Lower Glacial sand of that place. Not a vestige of the shell has yet occurred in any bed that can be shown to be as old as the Chillesford Clay. In all the Glacial and Post-glacial Beds, from the oldest to the newest, it occurs in profusion, which is the character of its occurrence as a living shell.

Tellina crassa, *Penn.* Crag Moll., vol. ii, p. 226, Tab. XXI, fig. 1.

Localities. Cor. Crag, Sutton, and near Orford. Red Crag, Walton, Sutton, and Butley. Fluvio-marine Crag, Thorpe, by Norwich. Chillesford bed, Chillesford. Middle Glacial, Hopton and Billockby.

This shell is abundant in every part of the Red Crag except at Walton, and in the Scrobicularia beds or uppermost part of the Red Crag. In the Fluvio-marine Crag it seems only to have occurred, and that rarely at Thorpe, from the bed of large angular flints, at the base of which section (supposed by some geologists to be of terrestrial origin) Mr. Crowfoot obtained it. I have not seen it from any locality of the Chillesford Bed except that of Chillesford itself. I have not met with it from the Lower Glacial Sands, but in the Middle Glacial sands it abounds, though in a more or less fragmentary condition.

Tellina lata, *Gmel.* Crag Moll., vol. ii, p. 228, Tab. XXI, fig. 6.

This shell is unknown at Walton, and rare in the rest of the Red Crag,[1] but very common in the Fluvio-marine Crag and Chillesford bed passim. It is not uncommon in the Lower Glacial sand of Rackheath and Belaugh, and some fragments from the Middle Glacial sand of both Hopton and Billockby may probably belong to it, but they are not sufficiently perfect for determination. I observed a perfect specimen in Mr.

[1] I erroneously stated in my paper on the "Red Crag," in the 'Quart. Journ. of the Geol. Soc.,' that it was common in the Red Crag of Butley, but such is not the case although I have found it there.

Rose's collection from the Nar Valley Brickearth, and it is mentioned by Mr. Seeley (under the name of *T. proxima*) as occurring in the gravel of March, though Mr. Harmer, who has searched the gravel of that place very assiduously, has not been able to meet with it.

The shell which I have called *lata* was figured by Lister, and called by him *Tellina lata alba*, and the name *lata* was adopted by Gmelin. This is the oldest notice of the shell. The late Edward Forbes, 'Mem. Geol. Sur.,' 1846, p. 412, considered *T. obliqua* as merely a variety of Lister's species from the seas of Norway. Although I have the highest respect for the opinion of the late E. Forbes (whose premature loss all geologists deplore) I must in this instance dissent from it, notwithstanding that it has been adopted by Mr. Jeffreys. Similarly E. Forbes regarded *T. prætenuis* as merely a variety of this shell, and Mr. Jeffreys has followed him. The word variety as distinguished from species is, to my apprehension, too vague to carry any precise meaning with it, but as regards these three forms, *lata*, *obliqua*, and *prætenuis*, there can be no question as to their complete distinction. *T. obliqua* is the only one of the three forms found in the Cor. Crag, but in the Red Crag lying between the Stour and the Alde we get this shell and *T. prætenuis* abounding together, and *T. lata* very rare, while in the Fluvio-marine Crag and Chillesford bed we get all three forms in abundance and well marked. I am sure that all collectors from the Crag will bear me out in saying that the three forms thus occurring in profusion together can be without difficulty selected, and that they do not form merely the terms of an undistinguishable series. They were therefore three distinct forms living in the same sea, and not intermingling; and what else constitutes species? Two of them are, so far as I am aware, not known living, for nothing recent that I have seen can justly be identified with either *obliqua* or *prætenuis*. In the first formation upwards from the Crag, viz. the Lower Glacial sands, *T. prætenuis* becomes rare, while *obliqua* maintains itself there in great profusion. As we ascend in the order of formations we lose the form *prætenuis* altogether, but still meet with *obliqua* in the Middle Glacial sands and at Bridlington, but it has not yet been met with in any Post-glacial bed, or in any of the English Newer Glacial, or in any of the Scotch beds; while *lata* not only occurs in these beds, but survives as an Arctic shell. The history of these most important shells (for it is the most abundant species that are the most important in a geological point of view) is thus clearly traceable in time through the various formations much in the same way as I have traced that of the common *Trophon antiquus*.

ABRA ALBA, *W. Wood.* Crag Moll., vol. ii, p. 237, Tab. XXII, fig. 10.

Localities. Cor. Crag, Sutton. Red Crag, Walton, Sutton, Bawdsey. Fluvio-marine Crag, Thorpe, by Norwich? Bulchamp? Chillesford bed, Chillesford? Aldeby? Post-glacial, Nar Brickearth, Pentney (*Rose*).

The localities of Thorpe, Bulchamp, and Chillesford are on the authority of the late Dr. Woodward's list, and, as I have not been able to confirm them, they are given with doubt. A specimen sent to me by Messrs. Crowfoot and Dowson from Aldeby seems not to be sufficiently perfect to be free from doubt.

Abra fabalis, *S. Wood.* Crag Moll., vol. ii, p. 238, Tab. XXII, fig. 12.

Dr. Hörnes has given this Crag shell as a synonym to the fossil from the Vienna basin, which he has called *Syndosmya apelina,* Kien, vol. ii, p. 77, Tab. VIII, fig. 4. This shell, however, judging from the figure he gives, resembles *Ligula profundissima,* Forbes; but mine is, I think, distinct from either, and I have, therefore, retained its original name.

Scrobicularia plana, *Da Costa.* Crag Moll., vol. ii, p. 235, Tab. XXII, fig. 14 (as *Trigonella plana*).

Localities. Red Crag, Bawdsey? Chillesford, and Sudbourn. Chillesford bed, Horstead, Chillesford, Tunstall Heath, and Sudbourn Church Walks. Fluvio-marine Crag, Bramerton. Lower Glacial, Belaugh. Middle Glacial, Billockby and Hopton. Post-glacial, March, Hunstanton, Nar Valley, Pentney.

The presence of this shell on the comparison of the Bramerton and Chillesford sections is discussed in the introduction to this Supplement. It occurs abundantly in the newest part of the Red Crag and in the Fluvio-marine Crag at Bramerton. It is not uncommon in the Lower Glacial sands, and in the Middle Glacial sands the hinge portion of specimens are very abundant. In all but the uppermost part of the Red Crag (4''' of the Introduction to this Supplement, page viii), of which it is the characteristic shell, it was unknown to me, but I understand from Mr. A. Bell that he has found it at Bawdsey.

Mactra ovalis, *J. Sow.* Crag Moll., vol. ii, p. 246, Tab. XXIII, fig. 1.

Localities. Red Crag passim excepting at Walton. Fluvio-marine Crag passim. Chillesford Bed passim. Lower Glacial, Belaugh, and Middle Glacial, Billockby and Hopton. Post-glacial, Kelsea Hill, Paul Cliff, March, and Hunstanton.

This shell abounds in every part of the Red Crag, excepting at Walton and in the Fluvio-marine Crag in the Chillesford bed and in the Middle Glacial, but is somewhat rare in the Lower.

Mactra solida, *Linné.* Crag Moll., vol. ii, p. 245, Tab. XXIV, fig. 4.

Localities. Cor. Crag, near Orford. Red Crag, Sutton, Bentley and Butley. Fluvio-marine Crag, Bramerton. Chillesford bed, Bramerton and Aldeby? Post-glacial, Kelsea Hill, March, and Nar Brickearth.

A specimen from Aldeby, sent me by Messrs. Crowfoot and Dowson, is referable with some doubt to this species. The specimen in the British Museum, which was the authority on which Dr. Woodward gave it as from Bridlington, does not seem to me to be a fossil of that place. It is said by Mr. Reeve to be now common at Bramerton. I have had figured in my Supplement, Tab. X, fig. 10, a peculiar and angular form, from Mr. Rose's collection, and this came from the Cor. Crag, near Orford.

Mactra subtruncata, *Da Costa,* Crag Moll., vol. ii, p. 247, Tab. XXIV, fig. 3.

Localities. Red Crag, Sutton? Fluvio-marine Crag, Bramerton. Chillesford bed, Aldeby.

Mactra stultorum. Crag Moll., vol ii, p. 242, Tab. XXIII, fig. 3.

Localities. Cor. Crag, Sutton. Red Crag, Sutton and Bawdsey (*Bell*). Fluvio-marine Crag, Bramerton. Middle Glacial, Hopton?

This shell seems to be rare in the Fluvio-marine Crag as well as in the Red, and not to have occurred in either the Chillesford bed, or the Lower Glacial sands; but a fragment comprising nearly the whole of the anterior edge of the shell and the hinge, from the Middle Glacial of Hopton, seems referable to this species.

Mactra glauca. Crag Moll., vol. ii, p. 241, Tab. XXIII, fig. 2.

In addition to the locality given in the 'Crag Mollusca' I have obtained several valves of this species from the Red Crag at Bentley, and I have seen others in the collection of Mr. Miller, of Ipswich. Some fragments that I have from the Cor. Crag of Sutton may probably be referred to this species; but it is difficult to determine satisfactorily from imperfect specimens the difference between *glauca* and *stultorum.*

Mactra arcuata. Crag Moll., vol. ii, p. 243, Tab. XXIII, fig. 5.

Localities. Cor. Crag, Sutton, Ramsholt, and near Orford. Red Crag, Walton, Sutton, Bawdsey. Fluvio-marine Crag, Yarn Hill and Postwick.

This shell has recently been found at Postwick by Mr. Reeve, and some young specimens from Yarn Hill were sent me by Messrs. Crowfoot and Dowson.

In Mr. Jeffreys' list (appended to Mr. Prestwich's paper) *M. arcuata* is given as a var. of *M. glauca,* from which opinion I dissent. There appears to me a greater difference between *glauca* and *arcuata* than there is between *glauca* and *stultorum,* which are both recent forms. *M. arcuata* is only known to me as a fossil.

Mactra artopta. Crag Moll., vol. ii, p. 244, Tab. XXIII, fig. 4.

This is at present restricted in England to the Cor. Crag, and there it is rare to my researches. It may probably be referred to *Mactra podolica,* Eichw., in Hörnes' 'Vienna Foss.,' vol. ii, p. 62, Tab. VIII, figs. 1—8, where several varieties are figured. *Mactra deltoides,* Dubois, 'Voth. Pod.,' Tab. IV, figs. 5, 6, may also be the same species; but *semisulcata* is quite distinct. *M. artopta* is not known to me as living species. It is placed by Mr. Jeffreys in his list to Mr. Prestwich's Cor. Crag paper as another variety of *glauca,* but from that I dissent.

Lutraria elliptica, *Lamarck.* Crag Moll., vol. ii, p. 251, Tab. XXIV, fig. 1. Supplement, Tab. X, fig. 19.

Localities. Cor. Crag, Ramsholt, Sutton, and near Orford. Red Crag, Sutton.

In 'Brit. Conch.,' vol. ii, p. 431, *Lutraria oblonga* is said to occur in the Coralline Crag, and the specimen now figured (which is from my collection in the British Museum) has that name written by Mr. Jeffreys on the back of the tablet, and he has introduced the name in his list to Mr. Prestwich's Cor. Crag paper. I have in consequence had the specimen in question figured. It was included with my other specimens as a variety of *elliptica,* which I still believe it to be, and have in consequence retained it under that name. The specimen in question resembles a figure by Dr. Hörnes, 'Foss. Moll. Wien,' Pl. V, fig. 7 *a—c,* which he gives as a variety of *oblonga,* but which M. Cha. Mayer has considered a distinct species under the name of *Lutraria Hornesii* ('Moll. Tert. du Mus. Zurich,' p. 52, fig. 47, 1867).

A fossil in my possession from Bordeaux, with the name of *L. sanna*, which was sent to me many years ago by the Comte du Chastel, seems to correspond with the specimen now figured, but is unlike the figures of *L. sanna* given by Basterot, Pl. 7, fig. 13. I have under these circumstances omitted the name of *L. oblonga* from my tabular list.

Thracia distorta ? *Mont.*

This species is given by Mr. Jeffreys in his list to Mr. Prestwich's Cor. Crag paper, as occurring in the Coralline Crag. The only specimen that has come to my knowledge, upon which such reference could be made, is that figured by me in the 'Crag Mollusca' as a distortion of *T. pubescens* ('Crag Moll.,' vol. ii, p. 259, Tab. XXVI, fig. 1 *e, detruncata*), but I do not feel fully justified on the authority of this solitary distorted specimen in adopting the name of *distorta* into the list of Crag shells, and I give it, therefore, with doubt.

Thracia papyracea, *Poli.* Crag Moll., vol. ii, p. 260, Tab. XXVI, fig. 2 (as *Thr. phaseolina*).

Localities. Cor. Crag, Sutton, and near Orford. Chillesford bed, Sudbourn Church Walks. Lower Glacial, Belaugh.

Two specimens of this species have been found at Sudbourn, and one by myself in the Lower Glacial sand at Belaugh. This appears now to be generally admitted as *Tellina papyracea* of Poli, and as that has precedence in date to Lamarck's name it is here restored. *Anatina papyracea,* Gould, appears to be different, and to belong to the genus *Cochlodesma,* judging from the representation of the hinge.

Thracia ventricosa, *Phil.* Crag Moll., vol. ii, p. 262, Tab. XXVI, fig. 5.

Locality. Cor. Crag, Ramsholt, and near Orford.

This is still with me a very rare shell. In 'Brit. Conch.,' vol. ii, p. 40, as also in the list by Mr. Jeffreys accompanying Mr. Prestwich's paper, this Coralline Crag shell is referred to *Mya convexa,* W. Wood, but I cannot change the name I originally gave to the Crag shell, believing as I do that is distinct from this recent British shell *convexa.* In the 'Crag Mollusca' I referred the Crag shell to Phillips' species *ventricosa* with doubt, as it did not satisfactorily agree with a Sicilian specimen in my possession, but

which specimen, in its turn, did not quite correspond with Phillips' description of this species.

I have not been able to clear up this doubt, but Dr. Hörnes refers one of his Vienna shells to *ventricosa,* placing the Crag species with it as a synonym (Hörnes, 'Foss. Moll.,' vol. ii, p. 48).

PANDORA INEQUIVALVIS, *Linn.* Crag Moll, vol. ii, p. 270, Tab. XXV, fig. 5.

Localities. Cor. Crag, Sutton, and near Orford. Red Crag, Walton Naze, and Waldringfield. Middle Glacial, Hopton.

I expressed my opinion in the 'Crag Mollusca' that *inequivalvis* and *pinna* were not entitled to specific separation, following in this Montague, and I only separated them out of deference to the authors of the 'British Mollusca.' As my view has received the support of the author of the 'Brit. Conchology,' it seems desirable to unite the two forms under the same specific name. In the 'Crag Moll.' I gave *inæquivalvis* as the Coralline Crag form and *pinna* (*obtusa*) as the Red. Since then, however, I have found both in the Cor. Crag of Sutton, and Mr. Bell ('Ann. Mag.,' May, 1871) gives *obtusa* from the Cor. Crag near Orford.

The hinge portion of one specimen has occurred in the Middle Glacial, but to which of the two varieties it belongs cannot be said.

SAXICAVA ARCTICA, *Linné.* Crag Moll., vol. ii, p. 287, Tab. XXIX, fig. 4, and p. 285, Tab. XXIX, fig. 3, as *S. rugosa.*

Localities. Cor. Crag, Sutton. Red Crag, Walton, Sutton, and Butley. Fluvio-marine Crag, Bramerton. Chillesford bed, Bramerton and Aldeby. Lower Glacial, Belaugh. Middle Glacial, Billockby and Hopton. Upper Glacial, Bridlington and Dimlington.

I observed in the 'Crag Mollusca' that, although I had kept *arctica* and *rugosa* as distinct species, I did not believe in any grounds for their distinction. I have, therefore, now united them. The very gigantic *rugosa* form, so characteristic of the Canadian beds, seems confined to the later glacial beds of Britain, as it appears only at Bridlington, Dimlington, and in the yet more recent Clyde deposits. It belongs to the truly arctic fauna that established itself in Britain towards the close of the glacial period, and seems absent from the older glacial beds, in which the small smooth form alone occurs. The rugose form occurs in the Coralline and Red Crags, but of smaller size. The species is common in the Cor. Crag, but not so in the Red. In the Fluvio-marine Crag, in the Chillesford bed, and in the Lower Glacial sands it is rare, but it is extremely common (though always

fragmentary) in the Middle Glacial at Hopton, and in all these deposits it is the thin and non-rugose form that occurs. At Bridlington I believe it is not uncommon, but there and at Dimlington it is the gigantic rugose form that occurs.

SAXICAVA? FRAGILIS, *Nyst*. Crag Moll., vol. ii, p. 288, Tab. XXIX, fig. 6.

Localities. Cor. Crag, Sutton, and near Orford.

This shell was described by Montague under the name *Mytilus plicatus;* but *plicatus* of Chemnitz is a different species inhabiting the Nicobar Islands. I have, therefore, retained Nyst's name for our shell.

There are two or three small bivalves which have been hitherto called by different generic names, and have as yet no proper resting-place, and which I consider ought to have a distinctive generic appellation of their own. The first of these is the above *fragilis*. Another is *Saxicava ? carinata* ('Crag Moll.,' vol. ii, p. 289, Tab. XXIX, fig. 5), which I believe to be specifically distinct from *fragilis;* while it seems probable that a fossil of the older tertiaries of America called by Lea ('Contrib. to Geol.,' p. 48, pl. i, fig. 16) *Byssomia petricoloides* may prove a third; but the hinge of Lea's specimen is not perfect.

The subjoined list of synonyms shows how the first of these shells, *fragilis,* has been bandied about from genus to genus:

Mytilus plicatus, Mont. Test. Brit. Suppl., p. 70, 1808.
Saxicava plicata, Turt. Brit. Biv., p. 22, 1822.
— ? *fragilis,* Nyst. Coq. Foss. de Belg., p. 97, Pl. 4, fig. 10 *a*, *b*, 1843.
— *rugosa juv.*, Forb. and Hanl. Brit. Moll., vol. i, pl. 6, figs. 1—3.
Sphenia cylindrica, S. Wood. Catalogue, 1840.
Magdala plicata, Gray. List of Brit. Biv., p. 161, 1851.
Anatina — *id.* Ann. of Philos., 1825.
Psammobia?— Jeffreys. Ann. and Mag. Nat. Hist., vol. xix, p. 314.
Lyonsia — Forb. and Hanl. Brit. Moll., vol. i, p. 218, 1853.
Panopea — Jeffreys. Brit. Conch., vol. iii, p. 75, 1865.
Myrina oceanica, Conti., 1864. *Fide* Jeffreys, Brit. Conch., vol. v, p. 192.

SPHENIA OVATA? Crag Moll., vol. ii, p. 276, Tab. XXIX, fig. 7 (as *S. Binghami*).

Locality. Cor. Crag, Sutton.

The shell figured in the 'Crag Mollusca' was referred with doubt to the recent British species *Binghami*. Dr. P. Carpenter, however ('Geol. Mag.,' vol. ii, p. 153), says that the Crag shell more resembles *Sph. ovata* from the north-west coast of America.

Although I have not been able to see a specimen of that species to compare with it, yet, as I now think that the shell figured in the 'Crag Moll.' is not *Binghami*, I have assigned it (still with doubt) to the species mentioned by Dr. Carpenter, and on his authority. I have seen no further specimens of the shell.

SPHENIA BINGHAMI, *Turton*. Supplement, Tab. X, fig. 13.

Localities. Cor. Crag, Sutton. Red Crag, Sutton.

The specimen figured in this Supplement was given to me by Mr. Charlesworth, who found it in a fragment of indurated mud from the phosphatic nodule bed at Waldringfield, and this, I have no doubt, is identical with the recent shell *Sphenia Binghami*. I have retained the above generic name as I think the shell is distinct from *Mya* or *Corbula*. The left valve has a projection on which is placed the cartilaginous connector; this extends along and under the dorsal margin on the siphonal side, and the right valve has a depression for its reception. The interior of the shell is marked with a shallow sinus. This shell has been so fully described as a species by the British Conchologists that it is not necessary to repeat the description here.

Genus—LYONSIA.

Tab. X, fig. 17, of Supplement represents the hinge portion of a bivalve from the Coralline Crag of Sutton, which I believe belonged to a species of *Lyonsia*. This fragment shows the depressed and elongated pit beneath the dorsal margin in which, when alive, was placed the internal connector. This pit is peculiar in its form, but I cannot find that it has ever been represented; although *Lyonsia Norvegica* has been figured about twenty times and described under eight generic and nine different specific names, the hinge has been mentioned only so far as that it possessed a movable and calcareous ossicle. My fragment is very thin, fragile, and iridescent.

CORBULA CONTRACTA? *Say*. Supplement, Tab. X, fig. 11 *a*—*c*.

CORBULA CONTRACTA, *Say*. Journ. Acad. Nat. Sci., ii, 312.
— — *Gould*. Inv. Massach., p. 43, fig. 37.
— — Id. 2nd edit., p. 60, fig. 377.

Localities. Fluvio-marine Crag, Bramerton. Chillesford bed, Ditchingham and Easton Bavent. Middle Glacial, Hopton.

Some small specimens of a *Corbula,* which I have referred as above, were sent to me intermixed with *C. striata,* by Mr. Reeve, from Bramerton, and I have also some from Easton Bavent, and from the small patch of fossiliferous pebbles at Ditchingham. Some nearly perfect specimens have also occurred in the Middle Glacial of Hopton. These specimens are smooth, but that is usually the case with all those which can be readily referred to *C. striata;* the principal distinction, as pointed out by the American authors, is the nearly equal size of the valves of the present species, and the more inequilateral form of the valve, the posterior side being elongated. The recent shell is said to be abundant on] the Coast of Georgia and East Florida. The specimen figured is from Bramerton.

Corbula striata, *Walk. and Boys.* Crag Moll., vol. ii, p. 274, Tab. XXX, fig. 3.

Localities. Cor. Crag passim. Red Crag, Walton, Sutton, Bawdsey, and Butley, Fluvio-marine Crag passim. Chillesford bed passim. Lower Glacial, Weybourne, Belaugh, and Rackheath. Middle Glacial, Hopton and Billockby. Post-glacial, March, Hunstanton, and Kelsea Hill (*Jeffreys*), Nar Brickearth (*Rose*).

This shell is profuse in the Coralline, but somewhat rare in the Red, Crag. In the Chillesford bed it seems to be rare where this is in a Fluvio-marine condition, and commoner as it becomes more marine; but I have not met with it from the most marine development of the bed, viz. that at Chillesford. In the Lower Glacial sands it is common, and in the Middle Glacial very abundant; but I have not seen it from Bridlington. It does not seem common at any of the Post-glacial localities. Fig. 4, Tab. XXX, of 'Crag Moll.,' is the representation of a shell which I referred to *C. rosea,* but which I now believe to be a transverse variety of *striata.*

I have retained the name of *striata* for this shell, conceiving the right of priority to be with Walker and Boys, who figured the recent shell with that name in 1787, whereas the name of *gibba* was given to it by Olivi in 1792. Lamarck at a later date described a Paris basin fossil with the name of *Corbula striata,* and this M. Deshayes has ('An. sans Vert. du Bas. de Paris,' T. 1, p. 221), I think, very properly called *C. Lamarckii,* restoring to the recent shell the name of *striata.* The name *striata* was also adopted by the late Dr. Fleming in his 'Hist. of Brit. Animals,' a very able work at the time it was published, and for which the author has never received the credit he deserved.

Corbulomya complanata, *J. Sow.* Crag Moll., vol. ii, p. 275, Tab. XXX, fig. 2.

In considering, as I did in the 'Crag Moll.,' the Paris basin shell to be the same

as the Crag one, I was influenced by M. Deshayes' having united the Eocene fossil with a shell found in the Touraine Beds. There is, I now think, so great a difference between the two that they ought to be specifically separated; and as Sowerby's name for the Crag shell has priority I so retain it, leaving the Eocene species to find a new one.

Neæra obesa, *Lovén.* Supplement, Tab. X, fig. 9.

Neæra obesa, *Lovén.* Ind. Moll. Scand., p. 48, 1846.
— cuspidata, *Jeffreys.* Brit. Conch., vol. v, p. 191.

Locality. Coralline Crag, near Orford.

A single specimen of this species is all that I have seen, which was obtained by Mr. Alfred Bell, and it now belongs to W. Reed, Esq., of York, who has obligingly placed it in my hands for description. Mr. Jeffreys in the Supplement to his 'British Conchology,' p. 192, considered this specimen obtained by Mr. Bell and Lovén's species *obesa* as a variety only of *N. cuspidata;* but in a paper of his in the 'Ann. and Mag. of Nat. Hist.' for June, 1870, on the "Norwegian Mollusca," Mr. Jeffreys says that his reference of *obesa* to *cuspidata* was erroneous, and that he is satisfied that the two species are distinct. Still later, however, in the list to Mr. Prestwich's Coralline Crag paper, he omits *obesa* as a Crag species. I consider it, however, a good species, and have so inserted it.

Poromya granulata, *Nyst* and *Westendorf.* Crag Moll, vol. ii, p. 268, Tab. XXX, fig. 5 *a—f.*

I have seen this shell from the Cor. Crag only, and there it is by no means abundant. This species was found by Edward Forbes in the Ægean, and although found on the Scandinavian Coast, I consider it properly a southern form. Mr. Jeffreys figured and described a minute bivalve as *Poromya subtrigona,* 'Ann. and Mag. Nat. Hist.,' 3rd series, 1858, p. 42, Pl. II, fig: 1, but in 'Brit. Conch.,' vol. ii, p. 228, he refers this shell to the young of *Kellia cycladia.* I am not aware, therefore, of any other species of this genus besides *granulata.*

Panopea Norvegica, *Spengler.* Crag Moll., vol. ii, p. 281, Tab. XXIX, fig. 1.

Localities. Red Crag, Sutton and Butley. Fluvio-marine Crag, Bramerton. Chillesford bed, Chillesford. Middle Glacial, Hopton. Upper Glacial, Bridlington.

This shell, though occurring in the Red Crag of Butley, and found in the Chillesford bed at Chillesford with the two valves united, does not appear yet to have occurred at its other localities. In the Middle Glacial sand of Hopton a fragment comprising the hinge and umbonal portion of the shell, showing lines of growth, has occurred. I am not aware whether it be common or not at Bridlington. The genus *Panopea* is certainly not appropriate for this species; but as *Saxicava,* in which other authors place it, appears to me equally inappropriate, I have, until a more suitable genus be erected for it, retained it under the generic name in which it was first figured from the Crag.

PANOPEA FAUJASII, *Menard de la Groye.* Crag Moll., vol. ii, p. 283, Tab. XXVII, fig. 1 *a—f.*

Localities. As in 'Crag Moll.'

In the 'Catal. Syst. et descr. des foss. de Terr. Tert.,' by M. C. Mayer, 1870, three species are given from the English Crag as distinct, viz. *P. Menardi* (*P. gentilis,* Sow.), from the Red Crag, and *P. Rhudolphii* (*P. Ipsviciensis,* Sow.), and *P. Americana,* Conrad, from the Cor. Crag. Having, however, seen and examined a large series of the Crag species of this genus, which present great variation among themselves, I am still of opinion that those shells which I have represented in 'Crag Moll.' all belong to one and the same species.

MYA ARENARIA, *Linn.* Crag Moll., vol. ii, p. 279, Tab. XXVIII, fig. 2.

Localities. Red Crag passim, except Walton. Fluvio-marine Crag passim. Chillesford bed passim, except Chillesford. Lower Glacial, Belaugh, Rackheath, Wroxham, Spixworth, and Crostwick. Middle Glacial, Hopton, Clippesby, and Billockby. Post-glacial, March, Hunstanton, and Nar Brickearth, Pentney (*Rose*).

This species I have not yet seen from the Cor. Crag, nor from the oldest part of the Red, viz. that of Walton Naze. I have found it plentifully in the Red Crag at Sutton, where the variety *lata* is also met with, and I have not seen this variety from any other locality. It is common in the Fluvio-marine Crag at Bramerton, where distortions are not uncommon; but at Chillesford, where *truncata,* a less littoral shell abounded, I have not met with it. In the Lower Glacial sands, where they are fossiliferous, it is common. Fragments are numerous in the Middle Glacial sands of Hopton, and it has been found by Mr. Rose in the Nar Brickearth.

MYA TRUNCATA, *Linn.* Crag Moll., vol. ii, p. 277, Tab. XXVIII, fig. 1.

Localities. Cor. Crag passim. Red Crag passim. Fluvio-marine Crag, Bramerton. Chillesford bed, Chillesford and Sudbourn Church Walks. Lower Glacial, Weybourn and Runton. Middle Glacial, Hopton. Upper Glacial, Bridlington. Post-glacial, March, and Kelsea Hill.

This species I have not seen from the Red Crag of Walton Naze, nor does it occur in that of Bentley. It is abundant, though generally small of size, in the Red Crag of Butley, especially in the *Scrobicularia* bed; and I am informed by Mr. Reeve that it is common in the Fluvio-marine Crag at Bramerton. Though once so abundant in the double state in the Chillesford bed at Chillesford, none can now be found there, but a colony of the double shells was found by the Rev. O. Fisher in the same bed at Sudbourn Church Walks. It occurs in the Lower Glacial pebbly sands at Runton Gap, double, and with its syphonal ends erect as it lived, and fragments of it are abundant in the Middle Glacial sand at Hopton. At Bridlington the ordinary form only, so far as I am aware, occurs, but Mr. Leckenby ('Geol. Mag.,' vol. ii, p. 348), mentions the variety *Uddevallensis* as occurring in the Boulder Clay, near Scarborough. *Uddevallensis* does not seem to have appeared in Britain until towards the close of the Glacial period.

PHOLAS CANDIDA, *Linné.* Supplement, Tab. X, fig. 25.

PHOLAS CANDIDUS, *Linn.* Syst. Nat., ed. xii, p. 1111.
— PAPYRACEA, *Spengl.* Skriv. Natur. Selsk., vol. ii, pl. i, fig. 4.
Lister, Hist. Conch., pl. 435, fig. 278.

Length, $1\frac{1}{2}$ inch.

Locality. Fluvio-marine Crag, Bulchamp?

A single specimen of this species was obtained by the Rev. Jno. Gunn some years since, and given to the British Museum, and it has the above locality marked upon the tablet, but upon application to Mr. Gunn for a confirmation of this, he was not able, from lapse of time, to say precisely where the specimen was found.

There is every appearance of its being a Crag fossil, and I have no doubt of its being genuine, and that it may be referred to the above-named species. I have not heard of its having been found elsewhere as a fossil of the Crag or of any other of the Upper Tertiaries of East Anglia.

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PHOLAS PARVA, *Pennant.* Supplement, Tab. X, fig. 26.

PHOLAS PARVA, *Penn.* Brit. Zool., vol. iv, p. 77, pl. xl, fig. 13?
— DACTYLOIDES, *Desh.* 2nd ed., Lam., vol. vi, p. 45.
— LIGAMENTINA, Id. Elem. Conch., pl. iii, figs. 11, 12.
— TUBERCULATA, *Turton.* Brit. Biv., p. 5, pl. i, figs. 7, 8.

Length, $\frac{5}{8}$ inch.

Locality. Red Crag, Waldringfield.

Mr. Alfred Bell and Mr. Charlesworth lately obtained some blocks of clayey material from the nodule pits at Waldringfield, in which were lodged several specimens of this species, with the valves united in their natural position, and I am indebted to both those gentlemen for specimens.

The Crag fossil corresponds with the short variety of the existing species, which is nearly equilateral, but the imbricated radiations are closer and more numerous than upon any recent specimen that I have seen.

PHOLAS BREVIS, *S. Wood.* Supplement, Tab. X, fig. 24 *a*, *b*.

Locality. Cor. Crag, Sutton.

In the 'Crag Moll.,' vol. ii, p. 296, I spoke of a fragment of *Pholas crispata* having been found by myself in the Cor. Crag. This fragment I now believe does not belong to that species, and I have had it represented as above (Tab. X, fig. 24 *a*). I have also met with several other large fragments and some small perfect specimens (one of which I have figured 24 *b*) which appear to me to be the young of the same species, although in these young specimens the imbricated radiations approach much nearer to the dorsal margin on the siphonal side than they do on the large fragment. In the latter, however, they are faintly visible over this part, and may have become obsolete during the growth of the shell. The small specimens show a highly reflected dorsal edge behind the umbonal region, but this part is broken off in the larger specimens. In our present species the imbricated rays cover, even in the adult shell, as shown by the large fragment, more or less of the posterior half of the shell, which is not the case with *crispata*. In other respects the large fragment resembles *crispata*. The proportions also of both the figured specimens differ from those of *Ph. crispata*.

As the other fragments and imperfect small specimens, of which I have many, uniformly maintain the characters above referred to, the species seems to differ from any other known to me, and I have accordingly proposed for it the above name.

Pholas crispata, *Linn.* Crag Moll., vol. ii, p. 296, Tab. XXX, fig. 9.

Localities. Red Crag, Walton, and Sutton. Lower Glacial, Belaugh. Middle Glacial, Hopton. Upper Glacial, Bridlington. Post-glacial, Kelsea Hill and March.

As just explained, the reference by me of this shell to the Cor. Crag was a mistake for the above *Ph. brevis.* Fragments of a large *Pholas* are common in the Middle Glacial sand of Hopton, and, I think that there is little doubt of their belonging to this species; but it cannot be so affirmed with certainty. Mr. Jeffreys gives it (in fragments) from Kelsea Hill, and a fragment probably of this species has occurred at March. None of the specimens that I have seen indicate a magnitude of more than three inches.

Pholas dactylus is mentioned by Mr. Alfred Bell in 'Ann. and Mag. Nat. Hist.,' Sept., 1870, as from the Red Crag of Walton Naze, and Mr. Jeffreys has, on that authority I think, inserted it in his list to Mr. Prestwich's paper. Mr. Bell has not been able to find the specimen.

Pholas cylindrica, *J. Sow.* Crag Moll., vol. ii, p. 295, Tab. XXX, fig. 8.

Localities. Red Crag, Sutton and Walton Naze.

I stated in the 'Crag Moll.' that fragments of this shell occurred in the Coralline as well as in the Red Crag; but it now appears to me that these fragments belong to *Ph. brevis* and not to *cylindrica.*

Pholades are spoken of by Sir Charles Lyell in the 'Lond. and Phil. Mag.,' August, 1835, p. 82, as having been found at the depth of six or eight feet below the surface of the Cor. Crag at Sutton where not covered by Red Crag. Mr. Charlesworth, also, speaks of specimens of *Pholas crispata* occurring in the sand of the Cor. Crag at the depth of three feet from the surface; and I have obtained a specimen of the same species from the same locality at nearly four feet from the surface. In the interior of these specimens there was no Coralline Crag, but instead of it fragments of what appear to be Red Crag shells.

If these specimens found buried in the material of the Coralline Crag belong, as I presume they do, to the age of the Red Crag, it is evident that *Pholades* excavate to a depth beyond what they have hitherto been supposed to do, and that either these tubular excavations are by some means kept open to the surface so as to allow of the access of water, or else that the *Pholas* returns upwards to the water by the pressure of the foot, as the *Solen* does. The foot, however, in *Pholas* does not much resemble the same powerful organ in *Solen,* by which that genus is enabled to rise through the sand to the water.

PHOLADIDEA PAPYRACEA, *Solander*. Supplement, Tab. X, fig. 27, and Crag Moll., vol. ii, p. 298, Tab. XXX, fig. 10.

Locality. Cor. Crag, Sutton.

In the 'Crag Moll.' I figured two disconnected fragments from the Cor. Crag of Sutton of what appeared to me to belong to this species, and I have recently found a small specimen which undoubtedly belongs to it. This is figured in Tab. X of this Supplement and is from the same locality of Sutton.

In Mr. Jeffreys' list appended to Mr. Prestwich's paper (p. 485) this species is given as occurring in the Red Crag, but as no special locality is mentioned for it and I have not been able to see the specimen, I cannot admit the species as a Red Crag one. The figure I gave in 'Crag Moll.,' Pl. XXXI, fig. 23, is the representation of what I believe to be an extraneous fossil doubtfully belonging to this genus.

BRACHIOPODA.[1]

This division of the Mollusca is composed of animals that are considered to be of lower organisation than the *Bivalvia*. Although *Brachiopoda* are strictly bivalvia they differ essentially in their internal organisation from the rest of that class, and they have in consequence been separated from that section of the Mollusca.

The animals and shells of this group have been thoroughly examined by several of our ablest comparative anatomists and microscopists, and I must refer the reader to the elaborate work of Mr. Davidson, where the history of the entire Order is most ably given.

Although I defer to the much better knowledge of the subject, and adopt the terms of that gentleman, I cannot but repeat the objection which in my 'Monograph of the Bivalves of the Eocene Mollusca' I have made to the terms "anterior" and "posterior"

[1] The name of the 'Crag Mollusca' given to my Monograph has been objected to, on account of its omitting a portion of the fossils belonging to this class, and, therefore, does not fulfil the conditions required by the title. It was originally intended that the work should comprise everything belonging to the *Mollusca* which has been found in the Crag, but after its commencement Mr. Davidson undertook to describe for the Palæontographical Society all the fossil *Brachiopoda* of Great Britain, and I thought those of the Crag could not be excluded. The Crag Brachiopoda being so few, and a desire having been expressed by several persons that the 'Mollusca of the Crag' should be made complete, the opportunity afforded by the Supplement has been taken to include them.

as applied to those animals, because they are in the first place inapplicable to the character of the organism, and in the next they have never been universally employed in the same sense.

The vent of the animal of the Brachiopoda is said to be situated nearer to the umbo than is the mouth, and on that account the distinctions called "anterior" and "posterior" have been applied. The outer portion of the shell covers the arms and the greater part of the mantle, while the viscera and vital organs are in the umbonal part of the shell; and I think, therefore, that such terms as *visceral region* for the inflated portion and *brachial region* for that which is occupied by the spiral "arm feet" would better define the different positions of the animal, and could never be reversed or misapplied. There is also great confusion, or, at least, want of unanimity, in the use of the distinctive terms "ventral" and "dorsal" valves, the perforated one having sometimes been called ventral and at others dorsal, and *vice versâ*. Professor M'Coy has proposed that the name "entering valve" and "receiving valve" should be given to the two pieces, and Mr. Davidson further suggests that the perforated valve should be called "dental valve," and the imperforated one the "socket valve." However, as this author still distinguishes the two valves as "ventral" and "dorsal" I have followed his example.

In the *Bivalvia* the distinctions are founded upon the hinge furniture, either on the dental character, or upon the position of the *connector*, but in the *Brachiopoda* the distinctions are made dependent upon the apophysary system; viz. on the calcareous internal appendage for the support of their spiral "arm feet." The muscular system of the *Brachiopoda* also differs from that of the *Bivalvia*, inasmuch as the latter open their shells, as well as close them, by means of muscles, of which they have as many as eight, exhibiting a somewhat complex mechanical operation for the opening and closing of the valves; and this arrangement appears to me to be far less simple than that of the elastic connector of the *Bivalvia*, and to effect the object in a far less easy way. Whether this be a proof of inferior or superior organization I am not prepared to suggest, but it does appear from it that the rule that nature adopts the simplest method for attaining a result is not one of universal application.

The valves of the *Brachiopoda* are, with some exceptions, more or less of an ovate form, the longer axis being generally from the umbo to the opposite margin, and the length of the shell is measured in that direction; the breadth, therefore, being at right angles to this line, and the depth having relation only to the tumidity of the valves. This is not in accordance with the measurement of the *Bivalves* as adopted by myself, but it is the mode that appears to be generally accepted, and I have, therefore, measured my shells by that standard.

TEREBRATULA GRANDIS,[1] *Blumenbach.* Supplement, Tab. XI, fig. 5 *a—g*, from the Cor. Crag; Supplement, Tab. VIII, fig. 11 *a—c*, from the Red Crag.

TEREBRATULA GRANDIS, *Davidson.* Brit. Tert. Brach., p. 16, 1852.

Length, 5 inches; *breadth*, $3\frac{1}{4}$ inches; *depth*, 2 inches.

Localities. Cor. Crag, Ramsholt, Sutton, and near Orford. Red Crag, Walton Naze, Sutton, and Waldringfield.

Some years ago specimens of this species were procured by myself in great abundance both at Sudbourn and Ramsholt, in the Coralline Crag, but recently they have become somewhat scarce. This is the largest and most noble of the species that I am acquainted with, and if I had to give it a name it should be called *nobilissima*, but unfortunately it has too many synonyms.

It is only within a few years that I have been able fully to display the internal furniture of this species. A specimen in the British Museum presented by myself and found at Ramsholt seemed to give fair promise of permitting the removal of the sand from the interior, and I was enabled with care to exhibit *in sitû* the short reflected loop of which I have given a figure. All doubt is by this removed respecting its true generic position, Prof. King having imagined that it was furnished with an internal apparatus much prolonged, like that which he has taken for the type of his genus *Waldheimia*, where the loop is extended to more than two thirds the length of the shell, whereas in *grandis* it proves not to exceed one third. Mr. Davidson always imagined it to be a true *Terebratula*, but he had not seen the perfection of the loop. I may further observe that *grandis* possesses a very long *spur* or *crura*, and a very little more extension to this would have united the two parts so as to form a ring like that which characterises the genus *Terebratulina*. Whether this be so in the young state I have not been able to see.

Specimens of *grandis* have come into my possession that measured nearly five inches in length, and fragments have been found which indicate even larger dimensions. The difference of size between the fry or infant state and the full-grown shell is so great as to be not often observable in any animal. I have found what there is every reason to believe is the young (and perfect) state of this species, with its longest diameter not more than the twentieth part of an inch, which will give to the full-grown shell an increase of one hundredfold at least *in linear direction*, and as in these large shells the young state of the longest or perforated valve has entirely disappeared, probably to the extent of one third of an inch, my estimate of these differences between the young and old is rather

[1] For generic and specific descriptions see Davidson, 'Monograph of the British Tertiary Brachiopoda,' published by the Palæontographical Society.

within the mark than otherwise. Although large, this shell is somewhat thin in the brachial region, and the Coralline Crag specimens are generally either cracked or compressed simply by the weight of the matrix in which they are imbedded; but it becomes excessively thick by deposition of calcareous matter in old specimens, in the region of the viscera under the denticles of the larger valve.

Mr. Charlesworth, in the 'Mag. of Nat. Hist.,' 1837, observed that the specimens of *grandis* found in the Red Crag up to that time were always separated valves, and it was inferred in consequence that these specimens were derived from an older formation. Specimens of this shell have, however, lately been turned out by the diggers for Coprolite in the Red Crag at Waldringfield in considerable numbers, many of which are in the possession of Mr. Charlesworth and Mr. Bell. These have the two valves united, and were probably inhabitants of the Red Crag Sea. They differ in outline from the Coralline Crag shell, being generally much more elongated and less regularly ovate or elliptical, having the brachial region more expanded, and the opening for byssus larger; but I believe they are all only a variety of this variable shell, well called *T. variabilis* by Sowerby; and Mr. Davidson is of the same opinion. Specimens of these I have had figured as above referred to. This name is not in the list of "Norwich Crag" shells by Woodward, neither have I seen it from any other locality of the Fluvio-marine Crag, or from the Red Crag of Butley.

Terebratulina caput-serpentis, *Linné*. Supplement, Tab. XI, fig. 3 *a—c*.

Terebratulina caput-serpentis, *Davidson*. Brit. Tert. Brach., p. 12, 1852.

Localities. Coralline Crag, Sutton. Recent, Britain, Mediterranean, &c.

This is a very rare shell to my researches, and the few specimens that I have found are small and very young. They nevertheless present a considerable amount of variation, both in the outward form and also in the number of rays or ribs with which they are ornamented; one specimen, which measures one eighth of an inch in diameter, having only nine coarse large ribs, while another of the same dimensions has fifteen, and one yet smaller only seven. The form also is variable, being elliptical or much elongated in one specimen, while in another it is nearly orbicular. The byssal opening is also variable, but this probably depends upon the position in which the animal had chosen to fix itself. In one specimen the larger valve has a recurved beak like that of *Rhynconella*, while in another this opening is nearly rounded and sloping backwards. In these young shells there is sometimes a sort of incipient shoulder at the hinge-joint like that in the young state of *T. Gervillei*, to which I had in my catalogue doubtfully referred the Crag shell, and the ribs are sometimes nodulous.

This species is one of those which in the recent state is most remarkable for its

geographical extension. It is found in the seas of Britain, in the Mediterranean, on the shores of North America, also on the coast of Japan. It (or at least a shell not to be distinguished from it) occurs likewise in the southern hemisphere, and in the Pacific; indeed, it is almost difficult to say where it is not to be found. It has also a bathymetrical range from low-water mark into water of abysmal depth.

This ubiquitous animal has a special claim to our attention, as it seems to offer a defiance to our determinations. Conchologists are perplexed in their examinations, and fail to separate specimens from opposite hemispheres, north and south, east and west, by any distinctive marks usually denominated specific. The late Edward Forbes was inclined to believe that the shell called *T. striata* (' Geol. Rel. of the Existing Fauna and Flora of the Brit. Isles,' p. 73), found in the Chalk and Green Sand presented differences so insignificant from those of the existing *caput-serpentis* that he doubted whether the one was specifically distinct from the other. Mr. Davidson, after having thoroughly examined the fossils called *striata* and *striatula* with *caput-serpentis*, inclines to the opinion that they are all three distinct; but he acknowledges that the differences are but trifling, and even hesitates to give a decided opinion. I have examined carefully these species, and seen the differences pointed out; but unless they are allowed to have more importance than differences of equally slight degree are allowed to have in other families of Mollusca, I much doubt if the three forms be entitled to specific separation. The fossil species from the Upper Secondaries and Lower Tertiaries have generally been considered by palæontologists as specifically distinct; but it may be asked whether the great difference in age of the several deposits in which they have occurred may not in some degree have influenced palæontologists in their determinations. If the Green Sand shell be really identical with *T. caput-serpentis* it has the greatest antiquity of any Mollusc at present known, and, what is also remarkable, the existing shell exhibits no symptom of specific decline, as it flourishes in our own seas at the present day in great profusion; and its world-wide diffusion and great bathymetrical range seems almost confirmatory of its ancient origin.

ARGIOPE CISTELLULA, *S. Wood.* Supplement, Tab. XI, fig. 4 *a—d.*

TEREBRATULA CISTELLULA, *S. Wood.* Catal. Ann. and Mag. Nat. Hist., vol. v, p. 253, 1840.
ARGIOPE — *Davidson.* Brit. Tert. Brach., p. 10, 1852.

Diam. $\frac{1}{12}$ inch.

Locality. Coralline Crag, Sutton. Recent, Britain.

This does not appear to be abundant anywhere either as a fossil or as a recent species. I have found about twenty specimens in the Coralline Crag, and these show a considerable variation in outline, especially in the elevation of the umbonal portion of the larger valve.

The principal distinction presented by this species, and I believe of the whole genus, is the internal septum or septa of the smaller valve; and the loop is said to connect or to be supported by these thickened internal processes, so that the apophysary system is somewhat variable in different species; but the loop is so delicate in these small shells that it is very rarely preserved, even in the recent specimens, and they are not present in my fossils. The byssal aperture is very large in this species, so also are the hinge-denticles. The dorsal margin of the smaller valve is nearly straight and entire, the inner margin of this valve being crenulated all round up to the dorsal edge, and the valve is divided into two equal parts by a large and prominent septum. Mr. Jeffreys has lately referred the Crag shell with doubt to *lunifera,* a Mediterranean shell ('Rep. Dredg. among the Shetland Islands, 1868'); but there is great doubt about *lunifera,* so that I have retained my original name of *cistellula,* which, Mr. Davidson tells me, he also intends to do.

RHYNCHONELLA PSITTACEA, *Chemnitz.* Supplement, Tab. XI, fig. 2 *a—c.*

RHYNCHONELLA PSITTACEA, *Davidson.* Brit. Tert. Brach., p. 21, 1852.

Diam. $\frac{7}{8}$ inch.

Localities. Red Crag, Sutton. Fluvio-marine Crag, Bramerton, Thorpe and Postwick. Chillesford bed, Bramerton. Upper Glacial, Bridlington. Post-glacial, March.

This species is not abundant as a British fossil, and the valves are generally separated, although occasionally the two have been found united. It has considerable range as a recent species, but it is confined to the colder regions of the northern hemisphere. A species much resembling it has, however, been found in the southern hemisphere.

There is no loop to this shell, the spiral arms being attached to two small curved processes projecting inwards from the umbo of the imperforated valve; the hinge-teeth of the beaked or larger valve are very strong, and they are supported, as it were, upon a sort of partition extending from the base of the hinge-teeth towards the tumid portion of that valve, by which a strength is given to this shell which I have not observed in other *Brachiopoda;* for what especial purpose, however, this is used I am not able to say. The beak of the larger valve appears to have retained its infant condition, and is not worn away like that of *Terebratula.* Mr. Bell gives the shell from the Red Crag of Sutton ('Ann. and Mag. Nat. Hist.,' Sept., 1870), and Dr. Woodward, in his list in 'White's Directory,' gives it from Thorpe and Postwick. Mr. Reeve has found it, but rarely, in both the beds at Bramerton, and Mr. Harmer found it at March; Dr. Woodward gave it ('Geol. Mag.,' vol. i, p. 53) from Bridlington.

Discina fallens, *S. Wood.* Supplement, Tab. XI, fig. 6.

Discina Norvegica? *S. Wood.* Ann. and Mag. Nat. Hist., p. 253, 1840.
Orbicula lamellosa, *Davidson.* Brit. Tert. Brach., p. 7, 1852.

Diam. —?

Locality. Coralline Crag, Sutton.

The only specimens of this genus that have yet, so far as I know, been found in the Crag are the one figured by Mr. Davidson from my collection in the British Museum, and now figured as above, and another which I have since obtained, but of which the exterior is wholly concealed by *Cellepora.* The recent shell called *Orbicula lamellosa,* to which this fossil was referred by Mr. Davidson, is a native of the coast of Peru, but he now considers that the reference of the Crag shell to this species was incorrect.

A shell was obtained by Professor King at the depth of 1240 fathoms in Lat. 52° 8′ N., and 15° 30′ W. Long. (about 140 miles from land), which he described under the name of *Discina Atlantica.* Mr. Jeffreys, in his list of Cor. Crag shells accompanying Mr. Prestwich's paper, has referred my Crag shell to this species of Professor King.

I have had some correspondence with Mr. Davidson respecting this Crag fossil, and he is of opinion with me that it cannot be referred either to *Orbicula lamellosa* or to *Discina Atlantica,* and that, while placing it in the genus *Discina,* it ought, for the present at least, to have a distinct specific appellation. As Mr. Davidson originally described the Crag shell, I proposed to him that he should give it a new name and point out what he considered were the characters for specific separation, but he has left it to me to do this. The features which, so far as its meagre condition allow me to speak, distinguish the Crag shell from *Atlantica* consist in its less conical form, and in the more excentric position of its apex. I have, therefore, provisionally called it by the above name, *fallens.*

Lingula Dumortieri, *Nyst.* Supplement, Tab. XI, fig. 1 *a—c.*

Lingula Dumontieri, *Nyst.* In Davidson's Mon. Brit. Tert. Brach., p. 5, 1852.

Length, 1 inch; *breadth,* ½ inch.

Localities. Coralline Crag, Sutton, and near Orford.

Fragments of this shell are not particularly rare at Sutton, but I have been unable as yet to obtain a specimen that has not been more or less mutilated. A similar remark is made by M. Nyst respecting the same species found at Antwerp.

The genus *Lingula* has been generally considered as an inhabitant of tropical or sub-

tropical regions, but the Crag shell is by Mr. Jeffreys referred to a species lately obtained from the seas of Japan, *L. Jaspidea*, A. Adams. I am not able to express any opinion as to the correctness of this identification. My shell differs from *L. tenuis* in being less slender and in having the front margin more obtuse.[1]

The genus *Lingula* occurs at the base of the Silurian system, and has preserved a special uniformity of character throughout the whole geological scale, some of the species (*L. minima* and *L. Symondsi*) differing, so far as their testaceous remains are a guide, in only a trifling degree from our Crag shell. Moreover, so far as these remains indicate, it has never exhibited any large development of individuals, although there is scarcely a formation in which it has not left some trace of its existence, nor do we see any great variation among the individuals in regard to magnitude. As this genus has existed from the oldest Silurian strata, it can scarcely have escaped encountering a great variety of conditions, and if indications of climate are to be inferred from the presence of a genus in any deposit, what are we to infer from the presence of such a genus as *Lingula?*

ADDENDUM.

Several new forms having been discovered since the first part of this Supplement was printed, I find it necessary to add another plate with figures and descriptions of these species, and I take this opportunity to introduce some remarks as to other species which have occurred to me since that portion of this Supplement to which their place properly belonged passed through my hands.

Voluta Lamberti, *J. Sowerby*. Crag Moll., vol. i, p. 20, Tab. II, fig. 3.

Mr. Jeffreys in his list refers this shell (with a note of interrogation) to *Voluta Junonia*, Chemn.

I have again examined and compared my Crag shell with specimens of *V. Junonia* in the British Museum, and I find that it differs from *Junonia* in having a larger pullus, or a more obtuse apex, and when perfect, in the presence of close-set spiral striæ, of which there is no appearance in the recent shell. *Junonia* has also a more expanded outer lip, and is more "emarginate" at the base, and its proportional length of aperture is different from that of the Crag shell. *Junonia* was figured many years ago by Chemnitz, 'Conch. Cab.,' vol. ii, p. 16, pl. 177, figs. 1703 and 1704. Its distribution is somewhat uncertain, but it has recently been found in the Gulf of Mexico.

[1] The muscular impressions as represented in our figure are partly imaginary.

Mr. Sowerby, when originally describing *V. Lamberti* in 1816, spoke of some recent shells which he had seen (five in number) that resembled the fossil; and the Crag shell was treated by Sir Charles Lyell, in one of his early works, as belonging to a living species, on the authority of M. Deshayes. The question was fully examined by Mr. Charlesworth in the 'Magazine of Nat. Hist.' for 1837, pp. 37 and 90, and a figure is there given by him of a specimen of *Lamberti* on parts of which the spiral striæ (sharply cut) to which I have referred are preserved. In most of the Crag specimens these striæ have been removed, but on a small one from the Coralline Crag in the collection presented by me to the British Museum they are present.

Columbella Borsoni? *Bellardi.* Addendum, Plate, fig. 19.

Columbella Borsoni, *Bellardi.* Monog. Columb. Foss., p. 14, t. i, fig. 11.
— — *A. Bell.* English Crags, Proc. Geol. Association, 1872, p. 24.

Locality. Red Crag, Walton Naze.

The specimen figured above, being that upon which this species was introduced into the Crag fauna, has been kindly sent to me by Mr. R. Bell. It appears to me more to resemble the figure of *C. subulata* (*Murex subulatus*, Broc.), but I have not the fossils from Piedmont for comparison. It seems to differ from *C. sulcata* (the common species at Walton) in being more subulate with less convex volutions, in being quite smooth, and in having a more distinct canal. It somewhat resembles the young state of *C. sulcata* ('Crag Moll.,' Tab. 5, fig. 2 *d*), but possesses the denticulations in the mouth which in that species do not appear until the shell is full grown. The apex of our present shell has been destroyed. Under these circumstances I am not satisfied that the specimen is anything more than an aberrant individual of *sulcata*, but have felt that it was desirable to have it figured.

Columbella minor, *Scacchi.* Addendum, Plate, fig. 20.

Columbella minor (*Scac.* in *Phil.*). Catal., p. 10, No. 12, fig. 11.
Buccinum minus, *Phil.* En. Moll. Sic., p. 190, t. xxvii, fig. 12.

Locality. Cor. Crag, near Orford.

A single specimen with this name has also been sent to me by Mr. Robert Bell, and it is, I think, correctly referred. The Crag shell has the surface much eroded, but in its living state it was probably quite smooth.

Columbella abbreviata is given from the Red Crag by Mr. A. Bell in his list ('Proc. Geol. Assoc.'), p. 28, but I have not been able to confirm that reference.

Columbella scripta is given by Mr. Jeffreys in his list, to Mr. Prestwich's Red Crag paper, as from Sutton, Walton, and Waldringfield, but I have not been able to confirm that reference.

LACHESIS, *Risso.*

This generic name has been adopted by all our modern conchologists, and I have here employed it, but upon what special characters it is founded I do not know unless it be upon some peculiarity in the animal.

The name *Lachesis* is unfortunately used for a genus of *Reptilia* and also for a genus of *Arachnidæ*. The little shell *Buccinum minimum*, Montague, now called *Lachesis*, I have not yet seen as a fossil in England.

LACHESIS ANGLICA, *A. Bell.* Addendum, Plate, fig. 7.

Locality. Cor. Crag, near Orford.

Mr. Robert Bell has sent to me a specimen with this name attached. It has six volutions with a deep suture, and the last volution has about a dozen longitudinal ribs or costæ, which are made nodulous by the crossing of three or four large spiral threads or ridges. The mouth is ovate and about one fourth the length of the shell, with the outer lip denticulated within. There are also some coarse striæ below the volutions. It is the only specimen I have seen, and unfortunately the upper portion or apex is destroyed. Judging from the figure this appears to be distinct from *Lachesis* (*Buccinum*) *candidissima*, Phil.

BUCCINUM TOMLINEI, *Canham*, m.s. Addendum, Plate, fig. 11.

Locality. Red Crag, Waldringfield.

A single specimen as represented has been sent to me with the above name by Mr. Canham. It was found, he tells me, in the workings for "Coprolite," on the ground of Colonel Tomline, whose name he wishes to commemorate as a friend to science, and a gentleman who has given him every facility for obtaining Crag specimens.

This shell resembles *B. Dalei*, but it differs in several particulars, so as to justify in my opinion a distinct specific position. It has a more elevated spire, with less tumid volu-

tions; the outer lip is more regularly rounded, and less expanded at the lower part than the lip in *B. Dalei,* and it wants the projecting ridge at the base of the *columnella.*

I have deferred giving this a regular diagnosis, but to leave it for confirmation as a species to the discovery of more specimens, and as it is most probably a shell extraneous to the Red Crag, some of its congeners may make their appearance in an older formation.

NASSA PUSILLINA, *S. Wood.* Supplement, p. 14, Tab. 2, fig. 7. Addendum, Plate, fig. 24.

Since this name was published I have been enabled to examine some recent specimens of that variable shell *Buc. variabilis,* Phil. (*Nassa Cuvieri,* Payr), and one of its varieties appears to correspond with the fossil figured by me under the above name *pusillina.* Mr. A. Bell, in 'Ann. and Mag. Nat. Hist.,' September, 1870, and Mr. Jeffreys in his list to Mr. Prestwich's Cor. Crag paper referred this shell to *N. Cuvieri,* Payr., and I here adopt that name in lieu of *pusillina.*

Very recently Mr. Robert Bell has sent to me a specimen from the Red Crag of Butley, which I have had represented in Addendum Plate, as above referred to. The ribs appear only on some of the volutions, a feature which is exhibited by one of Phillippi's figures of this variable species, and I have accordingly referred our present specimen to *Cuvieri.*

Nassa musiva ? Broc., is inserted in Mr. A. Bell's list as a species from the Red Crag, and a specimen with that name has been sent to me by Mr. R. Bell. It is, however, in bad condition, and appears to me to be one of the varieties of *N. reticosa* much rubbed and worn.

Nassa labiosa, J. Sow., from the Crag, is, I still think, distinct from *B. semistriatum* Broc., but it seems to correspond with a shell called *labiosa* by Beyrich, ('Die. Conch. Nordd. Tertiarb.,' p. 140, Tab. 8, fig. 5 *a—c*). The Red Crag specimens of *N. labiosa* are possibly derivatives from the Coralline Crag.

MUREX INSCULPTUS, *Dujard. ?* Addendum, Plate, fig. 9.

Locality. Red Crag, Waldringfield.

The figure referred to represents a specimen sent to me by Mr. R. Bell with the above name attached to it, and he tells me that it is identical with a fossil from Italy which he received from M. Seguenza with that name. I have, however, been unable to find this name in any publication known to me. M. Dujardin figures and describes a shell as *M. exiguus* in his paper on the fossils of Touraine, 'Geol. Trans. of France,' 1837, p. 296, Plate XIX, fig. 2, but our shell does not well correspond with it. It appears

to be intermediate between the figure of *exiguus* and *Buccinum lavatum*, Sowerby. It is, I think, a derived specimen.

TROPHON ELEGANS, *Charlesworth.* Crag Moll., vol. i, p. 46, Tab. V, fig. 2; Addendum, Plate, fig. 13.

At p. 98 of this Supplement I expressed my suspicions that this would prove to be a Cor. Crag shell, and to be only derivative in the Red Crag.

I have been confirmed in this by hearing from Mr. Canham that at a temporary recent opening in the Cor. Crag at Sutton the shell shown in the above figure occurred in numbers in association with numerous specimens of *Voluta Lamberti* and *Cassidaria bicatenata.* All of these, however, were in such a decayed state that only the specimen figured above could be extracted, and this is not full grown. Mr. Canham's Red Crag specimen measures 4½ inches in length.

It would appear from this that probably both *T. elegans* and *Cassidaria bicatenata* are present in the Red Crag only as derivatives from the Coralline, for while *V. Lamberti* (which by its occurrence at Yarn Hill is proved to have survived into the later part of the Upper Crag) is common in the only portion of the Red Crag which is not leavened with derivatives, viz. Walton, no trace of either *Cassidaria bicatenata* or our present *Trophon* has ever occurred there.

This shell is, I believe, quite distinct from any variety of *Trophon antiquus,* and is specially distinguished by the apex, which is not obtuse or mammilated, and the apex shown in Tab. VII, fig. 9, of this 'Supplement,' which I had imagined might be that of *Buc. Dalei* now belongs, I have now no doubt, to the present shell.

Fusus despectus, Linné, is given as a Red Crag shell by Mr. Jeffreys, and also by Mr. Bell, as from Sutton, Bramerton, and Thorpe. This I imagine must be the var. of *T. antiquus* with prominent carinæ like the shell figured 'Crag Moll.,' vol. i, Tab. V, fig. 1 *b,* which Edward Forbes ('Mem. Geol. Survey,' vol. i, p. 426, 1864) referred to *Fusus despectus.*

A very imperfect specimen has been sent to me by Mr. Canham with the locality "Red Crag, Waldringfield," which may probably be *Fusus Waelii,* Nyst, spoken of by Sir Charles Lyell, 'Quart. Journ. Geol. Soc.,' vol. viii, pp. 301 and 316, and described by Beyrich, p. 271, Taf. 20, figs. 1—3. This is, no doubt, a derivative.

TROPHON NORVEGICUS? Supplement, p. 21, Tab. V, fig. 14, and Addendum, Plate, fig. 16.

Locality. Red Crag, Sutton.

In Mr. Alfred Bell's paper on the English Crags, 'Proc. Geol. Assoc.,' vol. 2, p. 28,

is the name *Fusus Largillierti,* Fisch, as a species from the Upper Crag. The specimen on the authority of which this name was so introduced has obligingly been sent to me by Mr. Robert Bell (who tells me that Mr. Jeffreys so referred it), and it is figured as above. I have carefully examined and compared it with the figure and description of *F. Largillierti* by M. S. Petit, 'Journ. de Conch.,' vol. 2, p. 255, Plate 7, fig. 6, 1851, and can see no identity. Our shell differs in several respects, more particularly in being strongly striated, while *Largillierti* is smooth and in the form of the volutions and mouth. The specimen appears to me to be a distortion of *Norvegicus,* the position of the canal having been displaced by the same malformation of the animal which imparted the prominent shoulder to the whorl.

Pleurotoma clathrata ? *Marcel de Serres.* Addendum, Plate, fig. 8 *a, b.*

Pleurotoma clathrata, *Marc. de Serr.* Geogn. des Ter. Tert. de la Fa., t. xi, figs. 7, 8.
— — *Dujard.* Coq. Foss. Touraine, p. 294, pl. xx, fig. 6.
— — *Hörnes.* Vienna Foss., p. 379, t. xl, fig. 20 *a—c.*

Locality. Cor. Crag, Sutton.

A single specimen in my cabinet which I had considered as a variety of *Pl. Philberti* may, I now think, be referred to the above species. The cancellations are larger, coarser, and fewer, with the knobs more prominent, and the depressions deeper than is the case with *Pl. Philberti;* and, although I have not been able to compare my shell with a Touraine specimen of the species to which I have referred it, the foreign authors seem to me to justify the reference.

Pleurotoma tereoides, *S. Wood.* Addendum, Plate, fig. 3 *a, b.*

Spec. desc. *Pl. Testa minuta, fusiformi-turrita; anfractibus convexis, angulatis, supra planulatis, infra convexis; spiraliter lineatis, lineis incrementi conspicuis; labro profunde sinuato; cauda longiuscula aperto; apertura oblonga, spiram æquante.*

Locality. Cor. Crag, Sutton.

A single small specimen has lately rewarded my researches, of which the figure above referred to is a representation. It makes considerable approach to *Pl. teres,* Forbes, but is, I believe, distinct. I have compared specimens of the same size of *Pl. teres,* obtained by Mr. Jeffreys in his deep-sea dredgings, which I believe differ specifically from my Crag shell. Mr. Smith, of the British Museum, has shown to me a small specimen in the

national collection from the seas of Japan, which he believes to be at present an undescribed species, and proposes to call *Pl. turritispira.* This makes an approach to the Crag shell, but it differs in having a finely cancellated exterior and a smaller and shallower sinus in the lip. From the affinity which my shell bears to the existing *teres* I have given it the name of *tereoides.*

PLEUROTOMA BERTRANDI? *Payr.* Addendum Plate, fig. 4.

PLEUROTOMA BERTRANDI, *Payr* (fide *Phil.*). Cat. des Moll. Cors., p. 144, t. vii, figs. 12, 13.
— — *Phil.* En. Moll. Sic., vol. ii, p. 168.

Localities. Red Crag, Waldringfield, Sutton, and Butley.

This species is given by Mr. A. Bell in his list of the "English Crags," and Mr. Robert Bell has forwarded to me two specimens from Waldringfield with this name attached, and I have myself found a similar one at Butley. There are also some specimens in my collection in the British Museum. I give it with a mark of doubt.

PLEUROTOMA STRIOLATA, *Phil.* Addendum Plate, fig. 2.

PLEUROTOMA STRIOLATA (*Scac.*), ex *Phil.* Moll. Sic., vol. ii, p. 168, t. xxxi, fig. 7.
— — *Jeffreys.* Brit. Conch., vol. iv, p. 376, pl. xc, fig. 1.

Locality. Cor. Crag, near Orford.

The shell figured is one of my own finding. Mr. Robert Bell had a very perfect specimen showing the fine striæ, but unfortunately it has been broken or I would have had it figured. My specimen, however, shows traces of the striæ, and I believe it is correctly referred. Mr. Jeffreys in his list to Mr. Prestwich's paper gives this as a Red Crag, but not a Coralline Crag species. I have not, however, been able to confirm the reference of it to the Red Crag.

PLEUROTOMA RUGULOSA, *Phil.*

Mention is made at p. 46 of 'Supplement' of some specimens from the Coralline Crag that might be referred to this species. I have since, however, had reason to doubt whether these may not be the young of some other species.

PLEUROTOMA PYGMÆA, *Phil.*

This is given with a note of interrogation by Mr. A. Bell in his paper on the "English Crags," p. 28. I have not been able to see the specimen.

PLEUROTOMA ICENORUM, *S. Wood.* Supplement to Crag Moll., p. 35.

This is said by Mr. A. Bell in his list of the "English Crags" to be identical with *Pl. Hosiusii,* Könen, but on comparing my specimen with the German Oligocene shell there appears to be considerable difference. The Crag shell has much coarser striæ, and a very obtuse apex, while the second volution is smooth. The knobs on the Crag shell are much larger, and there is a second row of nodules near the suture, a peculiarity which I do not observe on the German shell. *Icenorum* also has a broader sinus and a shorter canal at the base than has the German shell.

PLEUROTOMA OBLONGA, *Ren,* is given in Mr. Bell's list of Red Crag shells, but with a query. Mr. Canham has sent to me a specimen from the Red Crag at Waldringfield, and I have also had one from Mr. Bell, both of which resemble in shape the species with this name, but they are in an imperfect condition, with the ornamentation obliterated, so that it would be hazardous to refer them under these circumstances, and as the specimens are, I have no doubt, only derivative in the Red Crag, I have not thought it worth while to have them figured.

APORRHAIS PESPELICANI, *Linné,* var. *Serresianus.* Supplement to Crag Moll., p. 49, and Addendum Plate, fig. 6.

CHENOPUS SERRESIANUS? (*Mich.*) *Phil.* En. Moll. Sic., vol. ii, p. 185, t. 26, fig. 6.

Locality. Cor. Crag, near Orford.

The above represents one of the specimens previously spoken of at p. 49 of this 'Supplement.' This appears to me to correspond with the figure and description of the Mediterranean shell as given by Philippi. Our Cor. Crag specimens are very variable, some having the ornamental nodules, as in this case, small and numerous, while others have little more than half the number, and there are forms intermediate between the two. Though my specimen has not the digitiform processes perfect, I can see no

material difference between it and some of the recent forms of *pespelicani*. *A. MacAndreæ* is probably only a variety. *Chenopus deciscens*, Phil., I do not know, but this is described as "*ultimo quadricarinato carinis nodulosis*," while my shell has only three keels or ridges.

CERITHIUM (TRIFORIS) PERVERSUM? *Linné*, var. *Belli*. Addendum Plate, fig. 17.

Locality. Cor. Crag, Sutton.

The above figure represents a small specimen sent to me by Mr. Robert Bell without a name.

The two forms or varieties called *C. perversum* and *C. adversum* (the latter of which is rather more slender than the other) are both found in the Cor. Crag at Sutton; but I have seen nothing so cylindrical as the present specimen. The recent shell, to which I have doubtfully referred it, is described by Mr. Jeffreys as variable, the volutions having three and sometimes four bands ('Brit. Conch.,' vol. iv, p. 261).

As our present shell has four unequal ridges (the lowest one very small, and the next one to it large and nodulous) I have not ventured to consider it as a distinct species on the strength of a solitary specimen, though, should more specimens occur, the question of its specific separation might with more reason be entertained.

CERITHIOPSIS TUBERCULARIS, *Mont*. Crag Moll., p. 70, Tab. VIII, fig. 5, Supplement, p. 52.

Since the first part of this 'Supplement' was issued Mr. Jeffreys kindly sent me for examination his British recent specimens, from which he formed two distinct species, under the names of *C. Barleei* and *C. pulchella* ('Brit. Conch.,' vol. v, Pl. 81, figs. 2 and 3). It does not appear to me that these shells present sufficient differences from *tubercularis* to entitle them to specific isolation, but they have all their exact representations among the Cor. Crag specimens. The principal differences appear to be a basal ridge or prominent spiral line which is present in some of my Crag specimens. Under these circumstances I have still retained them under the same specific name of *tubercularis*. Var. *subulata*, of 'Crag Moll.,' Tab. VIII, fig. 5 *b*, represents *C. Barleei*, and var. *nana* fig. 5 *c* represents *C. pulchella*, the convexity in the volution of this latter being probably caused by its abbreviated spire.

I have adopted the above generic name in deference to the malacologists, who say that there is a great difference in the animal from that of *Cerithium*, and this is also strengthened (it is said) by the present genus possessing a longer canal.

CANCELLARIA UMBILICARIS ? *Brocchi.* Addendum Plate, fig. 10.

VOLUTA UMBILICARIS, *Broc.* Conch. Foss. Subap., vol. ii, p. 312, tab. iii, figs. 10, 11.
CANCELLARIA — *Bellardi.* Foss. de Piemont., p. 36, tav. iv, figs. 17, 18.

Spec. Char. "*C. Testa ventricosa, anfractibus, scalariformibus, canaliculatis, longitudinaliter costata, profunde transversim sulcata, sulcis subimbricatis crispis, umbilico patentissimo, usque ad apicem spiræ pervio.*"—*Broc.*

Locality. Red Crag, Waldringfield.

The Rev. H. Canham has sent to me for representation a very perfect specimen which he has obtained from the Red Crag at Waldringfield, and this I have referred as above, with some doubt, as it does not strictly conform to any of the figures representing the foreign specimens under the name of *C. umbilicaris.* Our shell may probably be a dwarf variety of this species, with a depressed spire.

Our present specimen, there can be no doubt, is merely present as a derivative in the Red Crag, but whether it be derived from the Coralline Crag or from some older bed, there are not at present the means of judging.

I have from the Cor. Crag a very imperfect specimen belonging to this genus, which is distinct from any other that I have previously described, but it is too imperfect for representation. It somewhat resembles *C. elongata,* Nyst.

Cancellaria subspinulosa, Supplement 'Crag Moll.,' Pl. VI, fig. 10, may possibly be the young *C. lyrata,* Broc., but better specimens than I possess will be required for its determination.

PYRAMIDELLA LÆVINSCULA, *S. Wood.* Crag Moll., vol. i, p. 77, Tab. IX, fig. 2. Supplement, p. 57.

Mr. Jeffreys has kindly sent to me for examination some recent specimens obtained in the Mediterranean, and from his deep sea dredgings, which he considers identical with my Crag shell. On comparison I find the recent specimens more conical in shape, and more resembling *P. conulus,* Speyer ('Die Conch. der Cass. Tertiar.,' Tab. XXV, fig. 1. In his letter Mr. Jeffreys says, "There is some difference between the Porcupine and Crag shells, which I consider varietal only, consequent on some alteration in the conditions of habitat. I make some allowance for the great lapse of time and subsequent change of form." The lapse of time and alteration of conditions are, I believe, the main causes operating to produce new species, and inasmuch as the more our knowledge of recent and fossil forms extend, the greater will be the perplexity among palæontologists where to draw a line of specific distinction, and the more will they be driven for classification

and nomenclature to arbitrary lines of separation, it does not seem to me expedient in the face of the difference pointed out to regard this species as living. There is so much uncertainty respecting the shells that are to be referred to *unisulcata* or *plicosa* that I have retained the name originally given to the Crag species.

SCALARIA SEMICOSTATA, *J. Sowerby.* Addendum Plate, fig. 1.

SCALARIA SEMICOSTATA, *J. Sow.* Min. Conch., tab. 577, fig. 6.

Locality. Red Crag.

A beautiful and perfect specimen of *Scalaria* has been put into my hands by Mr. Charlesworth, but I believe it to be a derivative from one of the older tertiary formations. This specimen came originally from Mr. Whincopp, who had it from one of the diggers for "Coprolite," I presume from Sutton, whence he had most of his specimens.

Two figures are given by Mr. James Sowerby, tab. 577, fig. 5, as *S. reticulata* (*Turbo reticulatus,* Brander), V, fig. 6, as *semicostata.* In the very great accuracy of Mr. James Sowerby's general figures I have perfect faith, and I believe the two to be distinct.

M. Deshayes has figured and described a fossil from the "Sables moyen," 'An. sans Vert. du Bas. de Par.,' vol. ii, p. 343, Pl. 23, figs. 13—16, under the above name, which seems also to correspond with our shell. The specimen figured in 'Min. Con.,' Tab. 577, fig. 6, cannot now be found.

SCALARIA COMMUNIS, *Lam.* Addendum Plate, fig. 5.

SCALARIA COMMUNIS, *Lamark.* An. sans Vert., vol. vi, p. 228.
— — „ *Jeffreys.* Brit. Con., vol. ii, p. 91.

Locality. Post-glacial, March.

An imperfect specimen of this well-known British species was obtained from the March gravel by Mr. Harmer, and sent to me; and as no doubt perfect specimens will hereafter be obtained from that locality, I have had the figure drawn from a recent specimen.

This species is given as from the Red Crag by Mr. A. Bell in his list of the "English Crags," as also by Mr. Jeffreys in his list attached to Mr. Prestwich's Red Crag paper, but I have not been able to confirm these references.

Chemnitzia Jeffreysii ? *Koch* and *Wiechmann.* Addendum Plate, fig. 14.

Turbonilla Jeffreysii, *Koch & Wiech.* Moll. Faun. Sternb. Gest., p. 103, t. 3, fig. 9 *a*, *b*.

Locality. Cor. Crag, Sutton.

I have lately obtained from the Coralline Crag of Sutton an imperfect specimen, which, with the guide of the figures only, I have doubtfully referred to *C. Jeffreysii* of the German authors. It appears to differ from *Ch. elegantissima* in having the costæ more inclined, and without the bend or flexure present in that species, and from *elegantior* in the shape of the whorls. The figure in 'Crag Moll.,' vol. i, Tab. X, fig. 5, is not a good representation of the Crag shell *elegantior,* the costæ being straight, and not wavy, as there represented.

Eulima stenostoma ? Supplement, Tab. IV, fig. 25.

Since the engraving of this was made, my solitary specimen has unfortunately been much injured, and I am not now certain that it has been correctly referred.

Odostomia albella, *Lovén.* Addendum Plate, fig. 15.

Turbonilla albella, *Lovén.* Ind. Moll. Scand., p. 19, 1846.
Odostomia — *Jeffreys.* Brit. Conch., vol. iv, p. 121, pl. 73, fig. 1.

Locality. Cor. Crag, Sutton.

Mr. Robert Bell has sent to me for representation a specimen from the Coralline Crag, Sutton, with the name of *Odostomia albella,* and this, I think, is correctly referred. I have myself recently found a rather less perfect specimen from the same locality. Our shell has a very obtuse apex, smooth and glossy, and probably if we had several specimens quite perfect, one or other might show the sinistral embryonic nucleus spoken of by Mr. Jeffreys at the above reference. Our shell has a large fold upon the inner side of the aperture, and there is a distinct and somewhat large umbilicus. The peretreme is sharp and simple, but I am unable to detect any spiral striæ. *Odost. rissoides,* var. *albella,* Forbes and Hanl., Pl. 96, fig. 5, is probably the same shell.

Litiopa of 'Crag. Moll.,' vol. i, p. 88, Tab. IX, fig. 1, much resembles this species in its obtuse apex, but there is a truncation at the base of that shell which this has not. I am sorry to say the shell I called *Litiopa* is so scarce that I have not been able to find a specimen for many years.

Odostoma dentiplicata, *S. Wood.* Addendum Plate, fig. 18.

Locality. Cor. Crag, Sutton.

A single specimen of this genus has lately been found by myself which, in all respects, except in its denticulated outer lip, corresponds with *Od. plicata,* 'Supplement,' Tab. IV, fig. 22. Dr. Speyer has figured a shell under the name of *Odontostoma plicatum* ('Tert. Conch. Cassel,' Tab. XXV, fig. 3), which is probably the same as my species. It shows similar denticulations.

There are two or three other Crag shells in this genus, and in the genus *Rissoa* that seem to differ from recent species only in this character. See my remarks on *Rissoa semicostata,* p. 72 of this 'Supplement.'

Menestho Britannica, *A. Bell.* Addendum Plate, fig. 21.

Menestho Britannica, *A. Bell.* "English Crags," Proc. Geol. Assoc., 1872, p. 18.

Locality. Cor. Crag, Sutton.

The above figure represents the original shell forwarded to me by Mr. Robert Bell upon which the name of *M. Britannica* was introduced by his brother into his list of English Crag shells. The specimen agrees (especially in the sudden tapering off of the three upper whorls) with the description of *M. albula,* given in the 2nd edit. of Gould's 'Invertebrata of Massachusetts,' p. 333, except in the absence of fine striæ with which the American shell is said to be covered. Our present fossil is so well preserved that if it had been striated traces of the striæ would most probably be still capable of detection, and as I can detect none I have retained it under the name *Britannica* given to it by Mr. A. Bell.

Menestho Jeffreysii, *A. Bell.*

Menestho Jeffreysii, *A. Bell.* English Crags, p. 24, Proc. Geol. Assoc., 1872.

Two specimens from the Red Crag of Walton Naze have been sent to me by Mr. Robert Bell with the above name attached, and in his letter is the following remark: "This little shell was first identified by Mr. Jeffreys as a distinct species, and afterwards compared again by himself and my brother, and recognised as identical with some Arctic specimens he possesses. The name was given with his (Mr. Jeffreys') concurrence and permission."

The name *Menestho Jeffreysii* from the Red Crag is also given by Mr. Jeffreys at page 494 of Mr. Prestwich's Red Crag paper with the remark that the shell was previously known to him as an undescribed Greenlandic species. I have compared these two Walton

specimens with the shorter variety (fig. 12 *b* of Tab. XI of Crag Moll.) of *Rissoa costulata* (*P. Stefanisi* of 'Supplement,' p. 73), and, allowing for the way in which they are worn, I cannot detect any difference between them.

The Walton specimens, although worn, present in places the same ribs and the same cancellation as ornament the Cor. Crag specimen of this variety of *Stefanisi;* and particularly the form, relative dimensions, and position of the slight umbilicus are identical. I have not had the opportunity of examining the recent shells with which our fossils were identified, but if they be thus identical they can only, I think, belong to the shell figured 12 *b* of Tab. XI of the 'Crag Mollusca.' The description given by Mr. A. Bell of his new species *Jeffreysii* (Ann. and Mag. Nat. Hist., May, 1871, p. 10) quite accords with the specimens I examined and with the shell figured by me in Tab. XI of my original work.

Fossarus lineolatus, *S. Wood.* Crag Moll., vol. i, p. 121, Tab. VIII, fig. 23 *c—d,* as var. *lineolatus* of *Fossarus sulcatus.*

Fossarus lineolatus, *S. Wood.* Catalogue, 1840.

In the 'Crag Mollusca' are figured two varieties of *Fossarus sulcatus.* Mr. Jeffreys has referred one of them (var. *lineolatus*) to *F. Japonicus,* A. Adams. I have compared my Crag fossils with that recent species, and I believe them to be specifically distinct. The recent shell is shorter and more expanded, and it is ornamented with larger, coarser, and fewer ridges.

I treated var. *lineolatus* as a distinct species in my catalogue of 1840; and in this case, as in many others, I am inclined to revert to my views of 1840, and to call this variety a distinct species under my original name of *lineolatus.* M. Weinkauff refers *Fossarus sulcatus* of 'Crag Moll.' to *minutus,* Michaud, 'Bull. Soc. Linn.,' II, t. 122, figs. 7—9; but which of the two Crag varieties he thus refers I cannot make out.

Cyclostrema lævis? *Phil.* Supplement, Crag Moll., p. 86, Tab. V, fig. 13.

Since my Crag shell was figured Mr. Jeffreys has sent to me for examination a recent specimen which appears precisely to resemble my fossil, and this he considers to be a new species, and proposes for it the name of *basi-striata.* He adds (in Lit.) that *lævis,* Phil., is the same as *serpuloides,* but is different from the Crag shell. I think with him that the Crag shell is distinct from *serpuloides,* and I so considered it at p. 86 of this Supplement, and if it should prove to be the case that the Crag shell is not identical with Philippi's *lævis,* it will require a new specific designation, which may be that of *basi-striata,* which Mr. Jeffreys proposes.

Bulla utriculus ? *Brocchi.* Addendum Plate, fig. 26.

Bulla utriculus, *A. Bell.* English Crags, p. 19, Proc. Geol. Ass., 1872.

Locality. Cor. Crag, Gedgrave.

The specimen in the above figure was sent to me by Mr. Robert Bell, with the name *B. utriculus,* Broc., attached, being that under which it was inserted by Mr. A. Bell in his paper on the 'English Crags,' p. 19. Upon examination I find this specimen to be quite free from striæ of any kind, while *utriculus* is punctato-striated. It does not correspond with Brocchi's figure of either species.

It resembles, in its freedom from striæ, both Brocchi's and Hörnes' figures of *miliaris ;* but the figures of these two authors do not accord with each other in respect to the general form of the shell. Under this uncertainty, although I am inclined to refer the Crag shell to *miliaris* rather than to *utriculus,* I think it likely to give rise to less confusion if I figure it under the name in which it first appeared in Mr. Bell's list of the 'English Crags.'

The shell is umbilicated at both ends, and particularly so at the base.

Dentalium entalis, *Linné.* Addendum Plate, fig. 12 *a, b.*

In order to confirm the statements and fragmentary figures already put forward in this Supplement, page 22, and Tab. V, fig. 20, I have had represented a very perfect specimen obtained by Mr. Canham from the Cor. Crag, near Orford, which measures one inch and three quarters in length. The shell is beautifully smooth and glossy, even to its posterior termination, without a vestige of striæ, which, had they ever existed, could not fail to appear on so beautifully preserved a specimen. The terminal slit is *very* narrow, and nearly one fourth the length of the entire shell.

Bulimus lubricus, *Müller.*

Helix lubrica, *Müll.* Hist. Verm., pt. ii, p. 104.
Bulimus lubricus, *Brug.* Ency. Meth. Vers., vol. i, p. 311.
Zua lubrica, *Forb. & Hanl.* Brit. Moll., vol. iv, p. 125, pl. cxxv, fig. 8.
Cochlicopa lubrica, *Jeff.* Brit. Conch., vol. i, p. 292, pl. xviii, fig. 2.

Locality. Red Crag, Butley.

A single specimen, as above referred, was found by Mr. Canham, and it is the only one I have seen from the Crag ; it was accompanied with specimens of *Helix hispida,*

Succinea putris, *Limnæa palustris*, and what is probably *Limnæa Holbollii* from the same locality. This latter (of which I have myself found several specimens) seems to differ specifically from *palustris* in having a much deeper suture and more convex volutions. *B. lubricus* is common in the Post-glacial Freshwater deposits of this country; but I had not before known it from any deposits so old as the Red Crag. The other species have been previously figured as from the Fluvio-marine Crag, and are only mentioned here as occurring in the Red Crag. I have, at p. 4 of this Supplement, given what appears to me to be the true explanation of the occurrence of land and freshwater shells at this locality of the Red Crag.

CLAUSILIA PLIOCENA, *S. Wood.* Addendum Plate, fig. 22.

I have very recently obtained another land shell from the Cor. Crag of Sutton. This undoubtedly belongs to the above-named genus; but its specific identity is rendered uncertain by the fragmentary condition of the specimen.

Some of the animals of this genus in the living state are of arboreal habits, and my present specimen was probably, like *Helix Suttonensis*, carried into the Crag sea upon some dissevered piece of timber, and there deposited among the marine shells, or it may have been carried to sea on the feet or in the feathers of a bird.

Helix Suttonensis, from the same locality, approaches nearer to a living Madeira species than to any other that I have seen. I had hoped therefore to have been able to identify the present fragment with some species of *Clausilia* from that island, but I have not been successful in so doing; and am compelled therefore to give it provisionally a new name, for it does not agree with any British species known to me.

AVICULA PHALÆNOIDES, *S. Wood.* Supplement, p. 109, Tab. VIII, fig. 12 *a*, *b*, and Addendum Plate, fig. 23.

I have figured the hinge and umbonal portion of some shells of this genus from the Cor. Crag near Orford. None of the specimens of *A. tarentina* with which I have been able to compare the Crag fragments at all approach in the magnitude and thickness of their hinges these Crag *Aviculæ*, which are about intermediate in this respect between the living British and Mediterranean shell *Tarentina*, and the gigantic form from the Bordeaux beds called *Phalænacea*, Bast. There is such a close resemblance between the largest of these Cor. Crag hinges and those of the Bordeaux fossil that I have assigned to the Crag shell the specific name of *Phalænoides*. The fragments to which I referred in the 'Crag Mollusca,' vol. ii, p. 51, as probably belonging to *A. tarentina*, belong, no doubt, to the same species as the fragments here figured.

SCACCHIA LATA, *S. Wood.* Addendum Plate, fig. 25.

Locality. Cor. Crag, Sutton.

The above figure represents a shell recently sent to me from the Cor. Crag of Sutton, by Mr. Canham, which, I believe, is specifically distinct from any other yet described. It is thin, nearly transparent, very inequilateral and tumid, and with a smooth exterior. It slightly resembles *Sc. elliptica;* but it is more transversely elongate. It is the right valve and is quite free from that sinuosity in the dorsal margin which forms the distinguishing feature of this valve in *elliptica.* My shell is also edentulous in this valve. I have found in the Cor. Crag from the same locality a specimen of what appears to be the left or opposing valve of the same species, and this has one obtuse cardinal tooth, and is similarly inequilateral. The second specimen, which is not quite perfect, has been in my possession these thirty years and more, and I have hitherto been unable to refer it; but the discovery of the specimen now figured seems to throw light upon it.

The nearest shells to which this species approaches seem to be the older tertiary species *Erycina latens,* Desh., and *E. emarginata,* Desh, 'An. sans vert du Bas de Par.,' vol. i, p. 712, Pl. LI, figs. 24—27, and Pl. LIII, figs. 13—15.

THRACIA INFLATA, *J. Sow.,* var. *dissimilis.* Addendum Plate, fig. 27.

Locality. Cor. Crag, near Orford.

A single specimen as above represented has recently rewarded my researches, and from its peculiar form I think it desirable to have it figured. The species to which, as a variety, I have doubtfully referred it is somewhat variable, and I am unwilling, therefore, on the strength of a solitary specimen to describe it as a distinct species. The posterior slope is rugose, but it has not the regular shagreen character of *Thr. pubescens,* nor the convex or protruding ventral margin or sinuation of *convexa.* Should further specimens turn up preserving with integrity the distinguishing characters of this specimen, I should propose to assign it as a species under the name of *Thracia dissimilis.*

Venus dysera, Brocchi, is given in Mr. A Bell's 'English Crags' as a species from the Cor. Crag, and Mr. Robert Bell has lately sent to me a small specimen from that Crag at Sutton with this name attached. This is, I believe, merely the young state of *Venus imbricata,* and I have several similar specimens in my own cabinet.

CONCLUDING REMARKS.[1]

The science of Palæontology being one of pure observation, the lapse of a few years may be expected to make considerable alteration in determinations previously arrived at; thus, since the publication of the 'Crag Mollusca' I have been enabled to identify with existing species some of those forms which were considered to be extinct, and to correct errors consequent upon the possession, at the time, of imperfect specimens only, as well as those which the progress of our knowledge of the recent Marine Fauna had served to dispel.

The 'History of the British Mollusca,' by Messrs. Forbes and Hanley, having been published since the completion of my work, has furnished much information, and has supplied many notes for correction, which it had been my intention for some years past to publish with illustrations of new species obtained. I have also had, since then, the still greater benefit of the 'British Conchology,' by J. Gwyn Jeffreys, Esq., F.R.S.

The Crag formations have of late much occupied the attention of geologists and palæontologists, and Mr. Prestwich, in the 'Journal of the Geological Society,' vol. xxvii, 1871, has published three papers upon the Crag, in which he has availed himself of the assistance of Mr. Jeffreys to furnish tabular lists of the Mollusca of the Coralline, and of the Red and Fluvio-marine Crags, and Chillesford bed. As the determinations arrived at by the last-named gentleman differ in so many instances from my own, I have not considered it necessary to review them all in detail, but at the end of this Supplement I have given lists of all the Mollusca which have come under my observation from the Upper Tertiaries of that part of England to which I have confined this Supplement, in the way they appear to me to be specifically separated. Several species were spoken of in my original work as having been obtained by myself in abundance, or, at least, as not at that time being difficult to find, and I fear that this statement may have given disappointment to many collectors. Several species formerly abundant have, I am sorry to say, entirely eluded my search of late years, and this within a few yards distance of, and on the same

[1] The name "Coralline Crag" has been employed by myself for the older bed of these different formations, not only from what I conceive to be its special claim in regard to priority of date, but also from its correct and appropriate appellation. This name was given to it by Mr. Charlesworth, in 1835, in consequence of its composition being largely made up of what had been "Corallines," or "little corals," organisms so called by Ellis and others, such as *Cellepores, Retepores, Tubulipores, Flustræ*, &c. &c., but which have since been separated from the true corals. The Red Crag, from its rusty or reddish-brown colour.

vertical horizon as, the place of their former occurrence. On the other hand, some of those previously considered rare have become more plentiful.

In my list will be found many species to which my name is attached. Some of these will hereafter probably require to be altered through having been described by others previously to my work, but I have relinquished my own names wherever, up to the present time, I felt satisfied of the identity of my shell with any other previously described. In every case where I thought it could be justly identified with any other, whether known as living or not, I have not hesitated so to give it, suppressing, whenever occasion required, the name under which it had been previously known from the Crag in favour of any earlier name which the species with which it is thus identified may possess. After all this, however, there remains a wide difference between the view taken by me of the Crag Mollusca, and that taken by the author of the 'British Conchology;' indeed, while according to that author my tribute of admiration for the persevering industry with which he has so much enlarged our knowledge of the Mollusca of British seas, and of the waters adjoining them, I do not hesitate to point out what, in my judgment, impairs the conclusions he has expressed with reference to Crag species, both in his general work, and in those lists of which he is the author which form part of Mr. Prestwich's papers on the Crag already referred to. It is obvious that this author's leanings are very marked, so as to group together allied Crag forms as varieties only of one species, and especially to make out a Crag shell to be either identical with a living species, or, at most, only a variety of it wherever the slightest presumption can be found for that course. I observe, however, that this reluctance to recognise two distinct, but allied, Crag forms as anything more than a variety gives way when the form has been found living; and I have been particularly struck with this in the case of *Scalaria subulata*, which in the first, or 'Cor. Crag List,' is put in italics as a variety only of *Scalaria foliacea*, but which in a note to the 'Red Crag List' (page 496), is restored to specific importance in consequence of its having in the meantime been dredged living by Mr. McAndrew. The degree of difference which is to constitute a species must in a great measure be arbitrary; but there are many shells of the Crag thus identified with living ones which show quite as little variation from shells of the Older and Middle Tertiaries as they do from their living analogues. If species arise, as I believe they do, by gradual variation from forms previously existing[1] (be the cause of that variation what it may), it is obvious that, if we could get a perfect collection of all the forms that have existed and do exist on the surface of the earth, we should be placed in the dilemma of not being able to draw a specific line anywhere; and although it must be a long day, if ever, before such a knowledge of animal

[1] In a letter to me (April 27th, 1873) the author of the 'British Conchology' says, "I believe not in evolution, but in descent with modification;" and I observe the same phrase—"descent with modification" used by his colleague in the "Porcupine" dredging expedition, Professor Thompson, in his late work, 'The Depths of the Sea' (page 480). I confess that I do not understand the difference between this and evolution, in which I have for very many years been a believer.

life will be acquired, yet every increase of our knowledge of natural history must bring us nearer to this state of things, and proportionately augment our difficulties in the way of specific separation. In the present state of our knowledge, therefore, it seems to me more philosophical, and likely to be more advantageous in working out the history of the past changes of land and water on the globe, if the identification of species be not strained; and that, wherever a form presents differences from any other, though they be but slight, and those differences are fairly maintained in a group of individuals without intermediate forms occurring coevally in the same geographical area, such form should be regarded as a distinct species; in my 'Monograph of the Eocene Bivalves' I have expressed my views on that point more fully. Another reason for not undervaluing even slight differences by which many of the Crag Mollusca are separable from their living analogues, and so reducing them to the inferior importance supposed to be possessed by the term "variety," exists in the discordance between the evidence presented by the Molluscan fauna when thus reduced, and that presented by the other organisms of the Crag period. Thus the evidence of the *Entomostraca,* the *Foraminifera,* the *Polyzoa,* the *Polyparia*, the *Cirripedia,* and the *Echinodermata* of the Crag (all of them studied and described by independent authors) has quite a different bearing from that of the Molluscan fauna, when this last is reduced in the way it has been by the author of the 'British Conchology.'

In the case of the *Entomostraca* the proportion of species not recognised as living is as 13 to 5, of the *Foraminifera* as 47 to 53, of the *Polyzoa* as 65 to 30, of the *Polyparia* 3 to 1, of the *Cirripedia* as 4 to 6, and of the *Echinodermata* as 13 to 3.[1]

Now, although the researches which have been carried on among the living species of these groups of organisms may not have been so extensive as those carried on among the Mollusca, and although we may thus be better acquainted with the living forms of the latter, still, after making very large allowances on this account, we are left with great discrepancies between the evidence afforded by the percentage of forms not known living among the Mollusca, and those among the other groups. These discrepancies are so striking as to suggest caution in accepting the process by which the list of Crag species has been pared down, and so many species eliminated from it in the lists which accompany Mr. Prestwich's Crag papers.

The authors of the 'British Mollusca,' like myself, regard the Molluscan fauna of the Coralline Crag as having its affinities chiefly with that of the Mediterranean; but the

[1] A table of the proportions borne of living to extinct forms among these various groups of organism will be found at p. 134 of Mr. Prestwich's paper on the "Cor. Crag." This agrees substantially with the analysis given by me in the text. The number of species of Coralline Crag Mollusca, however, according to the list by Mr. Jeffreys, which accompanies the paper of Mr. Prestwich, is 316, of which he considers 264 to be living, and 52 extinct; thus giving a percentage of 84 recent and 16 extinct. 'Quart. Journ. Geol. Soc.,' vol. xxvii, p. 128.

author of the 'Brit. Conch.' differs from us,[1] and some time ago expressed his opinion that the Cor. Crag sea was the cradle of the British Mollusca. Now, although a number of Cor. Crag species that were not known to live so far north as Britain have lately been discovered living in our seas, this does not appear to me materially to affect the inference of the authors of the 'Brit. Mollusca' and of myself, because Molluscan, like other faunas, overlap each other, and species may yet linger as rareties in areas where they have long ceased to predominate. Similarly several Cor. Crag species have been now found to be denizens of Arctic seas; some few indeed are said by Mr. Jeffreys to be, so far as yet known, exclusively so,[2] while others range from Arctic seas down into British waters. We must remember that since the Coralline Crag period we have had great geological changes, the arctic conditions of the glacial period having fallen upon Britain, and again given way to our present temperate climate. Moreover, at the period of the Coralline Crag the Mediterranean and South European area was probably connected more directly with the Arctic than it now is, but the geographical changes which intervened between this and the Red Crag period appear to have produced an interruption of such direct connection, by giving rise on the east of Britain to a land barrier which shut off the Red Crag sea from the south and left it open to the north; the occurrence of a characteristic Red Crag Molluscan fauna fossil in Iceland, with some traces of it midway about Aberdeen, showing the extension northwards of this sea. By these means, as it seems to me, a part of the Cor. Crag species was induced to retire southwards and died out in Britain, while the other part survived there and some new importations came in. It is as probable that some of our present northern forms originated in and have migrated from seas far to the southward of Britain, as that they did so from the seas to the north, since we find *Panopea Norvegica, Mya truncata, Cyprina Islandica, Lucina borealis, Trophon contrarius,* and perhaps one or two more that are now unknown to the Mediterranean and considered as Arctic-British types, fossil in Sicily in association with forms that are mainly of Mediterranean types. After this change of coast lines, to which the Red Crag was due, had wrought its effect, the arctic conditions of the glacial period supervened, accompanied by a considerable submergence. This submergence destroyed the barrier which shut off the sea of the Red Crag from the southward, and once more brought the sea of the north east of Britain, and through it the Scandinavian and Arctic areas into direct communication with the Lusitanian and Mediterranean seas to which the one part of the Cor. Crag Mollusca had retired, and the conditions favorable to an intermingling, or at least an overlapping of the

[1] 'Brit. Conch.,' pl. lxxxix, Introduction, where it is said, "my investigation of the Crag shells has not led me to form the same conclusion as Messrs. Forbes and Hanley, viz. that most of these ancestors of our living shell-fish are of those forms which we regard as southern types."

[2] There are three species in Mr. Jeffreys' list of Cor. Crag shells to which the letter A alone is attached, signifying that these are exclusively Arctic species, viz. *Velutina virgata* as *V. undata*, Smith; *Cardium strigilliferum* as *C. elegantulum*, Beck; and *Glycimeris angusta* as *G. siliqua,* Chemn. None of these identifications are to my mind satisfactory and I have not adopted them.

faunas were repeated.[1] After this, and at probably the very last geological period that we recognise in Britain, the two areas were once more divided by an isthmus between Kent and France, which enabled the southern fauna to range up the British Channel without intermingling with or overlapping that of the Arctic province. This was the period of the Selsea mud bed in which a considerable and well-preserved fauna of southern affinities occurs—a fauna which has its living analogue on the southern coast of England, and in which are some few species that now occur only on the Lusitanian or Mediterranean coasts. Besides all this, the exceptional character of the Scandinavian fauna, due, it would seem, to that drift of warm water, which keeps the bays and fiords of Norway free from ice, forms another complicating element in the question; while the influence of vast stretches of abyssmal water supporting Mollusca (of which some have been hitherto considered characteristic of Mediterranean areas, and others of northern and even Arctic areas) in intermingling distant faunas has yet to be elucidated.

It thus appears to me that if any of these past periods could with propriety be termed "the cradle of the British Mollusca," it would be rather the Red than the Coralline Crag. Strictly speaking, however, it would, owing to the alternate interminglings and separations already referred to, be misleading to refer to any one of these past periods as having formed the cradle of the British Mollusca. In speaking, therefore, of the Coralline Crag fauna having its affinity with that of the Mediterranean, I mean merely to imply that the major part of the living species of the Cor. Crag are of Mediterranean habitat, and that of such among this part as are common to the Mediterranean and British areas, the greater number are more abundant in individuals in the Mediterranean than they are in the British waters; and that, so far as conditions of temperature can be inferred from a Molluscan fauna, these conditions during the Coralline Crag period would seem to be nearer to those of the seas of southern Europe and of the Azores than to those surrounding the British Islands.

According to the analysis of my Synoptical List (post, page 219), there are 205 species of Gasteropoda and Bivalvia living in the Mediterranean which are identical with Coralline Crag species, among which there are 51 that are not known in the British seas. On the other hand, there are 20 species of British Mollusca in the Coralline Crag that are not living in the Mediterranean. It should not be forgotten that the most abundant, and therefore most characteristic species of the Coralline Crag, such as *Cardita corbis*, *Cardita senilis*, *Limopsis pygmæa*, *Ringicula buccinea*, and others, are southern species unknown to British seas; and that among the 154 Coralline Crag species occurring both in British and Mediterranean waters there are many which are really characteristic Mediterranean shells, and are only marked British in consequence of some rare occurrences, due to the

[1] The remarkable molluscan fauna, extracted with difficulty from the middle Glacial sands, and still far from complete, throw much light on this history. Several Coralline Crag and Mediterranean species, of which we get no trace in the Red Crag, or at least in the newest part of it, or Chillesford bed, again making their appearance, though the specimens have evidently travelled far along the bottom. At this period the great Glacial submergence fully set in, if, indeed, it did not attain its maximum.

perseverance of our naturalists in dredging the extensive stretch of sea which, extending over 12 degrees of latitude, surrounds the British isles. In making these comparisons, moreover, it should not be overlooked that we contrast results obtained from a patch of fossil sea bottom only a few yards square in Suffolk,[1] with results obtained from the vast area surrounding the British islands. If instead of this a comparison could be instituted between the Coralline Crag fauna and that which might be obtained from an exhaustive dredging of the bottom of the North Sea off the Suffolk coast, my belief is that the exotic character of the Coralline Crag sea would become much more apparent.

How far during the intercourse which has gone on by ships between Britain and the Mediterranean and Lusitanian coasts for 2000 years past, Mediterranean and Lusitanian Mollusca have been introduced into British waters through the agency of the bottoms, anchors, and especially the ballast of ships, it would be rash to conjecture; but the extent of this cannot have been inconsiderable, especially during the last two centuries. Whatever the degree to which this has extended may be, it has by so much reduced the exclusively Mediterranean and Lusitanian proportion of the Coralline Crag Mollusca below its real amount. Of course the same process must have had similar results in introducing British species into Lusitanian and Mediterranean waters.

The numerous species and profusion of individuals of the genus *Astarte*, the presence of the genus *Cyprina*, and of such shells as *Trichotropis borealis* and *Glycimeris angusta*, represent, on the one hand, what would be urged in support of the arctic and boreal features of the Coralline Crag fauna. On the other hand, the profusion of such species as *Limopsis pygmæa*, *Cardita senilis*, *Cardita corbis*, *Ringicula buccinea*, *Woodia digitaria*, and *Dentalium dentalis*, and the occurrence of the sixteen genera presently enumerated, represent the Mediterranean features. Besides these we have the tropical forms, *Pyrula* and *Pholadomya*, which were probably present as lingerers from those periods anterior to the Crag which are clearly shown by their fossils to have been more and more tropical as we recede in Tertiary time. Although the genus *Astarte* among recent shells is looked upon as indicating boreal conditions in our present seas, inasmuch as only one species lives in the Mediterranean, yet as we recede in geological time this indication becomes weakened if not negatived altogether, and a proof is afforded that the genus did not in older Tertiary periods originate in icy seas. Thus in the Eocene of England we have no less than four species of this genus in association with such an undoubted tropical Mollusc as the *Nautilus*; and of these, two are from the London clay, the climate of which is proved to have been warm not merely by its *Nautili*, but by the tropical character of the vegetation yielded by the Sheppey deposit. In Mesozoic formations the genus goes back in some abundance of species as far as the Lias in association with gigantic reptilia, through climates indicated by the Purbeck vegetation

[1] To any objection that such a dredging would not disclose the contents of the North Sea bed *vertically*, I reply that there are but very few Coralline Crag species which I have not found within a vertical range of three feet in the stackyard pit at Sutton.

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to have been warm. Further, we have the following sixteen Cor. Crag genera not yet known to be living in the seas of Britain, of the North Atlantic, or of the arctic regions, viz. *Panopea*,[1] *Pholadomya*, *Chama*, *Hinnites*, *Erycinella*, *Scintilla*, *Nucinella*, *Lingula* (?), *Sigaretus*, *Pyramidella* (?), *Fossarus* (?), *Cancellaria* (rejecting *Admete*), *Cassidaria*, *Terebra*, *Pyrula*, and *Voluta*, to which might be added a section of *Pleurotoma*, and but for the late dredgings in abyssmal waters, the genus *Verticordia* also. The presence of these genera in the Coralline Crag seem to me to impart a more southern aspect to its fauna than any analysis of the species themselves would do.

There are a few forms both in the Coralline and in the Red Crag, the living analogues of which survive in seas so remote as to throw no light on the affinities of the faunas of those Crags. Of these in the Cor. Crag the little *Erato*, which I had identified with the West Indian species *Maugeriæ*, may be instanced. Mr. Jeffreys, however (in a letter), informed me that he thought the specimens in my collection (in the Brit. Mus.) might be stunted forms of *lævis*. I believe, however, that *E. Maugeriæ* is identical with the shell from the Cor. Crag figured by me under that name. I have compared many specimens of each without being able to detect a difference that might be called specific, or any more difference than may be observed among the specimens themselves, and I cannot consent to degrade my little Crag shell into the position of a variety, as it and the true *lævis* are found together at the same spot without intermediate forms.

The characteristic shell of the newer part of the Red Crag, of the Fluvio-marine Crag, of the Chillesford bed, and of the Lower, Middle, and Upper Glacial deposits, *Nucula Cobboldiæ*, is another of these instances; the living analogues of this shell, of which there are two or three, being denizens of the North Pacific; and although I have pointed out in the body of this 'Supplement' the characters which seem to me to distinguish *Nucula Cobboldiæ* specifically from all these allied species, yet it is very remarkable that its analogues should be several in number, and all of them confined, as far as yet is known, to so remote a sea.

In 1838 Mr. Conrad published figures and descriptions of some Medial Tertiary fossils of the United States bearing a strong resemblance to Crag forms; and in a paper upon these, published in the 'Proceedings of the Geol. Soc.' for the year 1843, Sir Chas. Lyell gives the names of several species that he considered to be identical with Crag, or, at least, with European fossils.

In the 'Geological Magazine' for April, 1865, vol. ii, is a communication by Dr. P. Carpenter upon the connection between the Crag and the recent Mollusca of the North Pacific, wherein he appears to consider the Crag fauna and the North Pacific fauna to have emanated from the north, the one diverging eastward and the other westward. He says at p. 153, "Not taking into account *similar* forms, no fewer than twenty-four species

[1] *Panopea Norvegica* does not properly belong to the genus *Panopea*, but perhaps to *Panomya*; see p. 161 of this Supplement.

have already been clearly identified on the West[1] Pacific coast; several of these can scarcely have travelled through Behring Straits, not being Boreal forms." The following species, now living on the north-west coast of America, are given by him ('Brit. Assoc. Rep.,' Newcastle, 1863) as identical with Crag forms. Those with an asterisk are also given as Tertiary fossils of Maryland and Virginia by Sir C. Lyell ('Proc. Geol. Soc.,' 1845, p. 555).

Coralline Crag Species.

Mya truncata, *Linn.*
Sphenia ovoidea (?), *Carpenter.*
*Glycimeris generosa (?), *Gould* (Panopea Faujasii).
Saxicava Arctica, *Linn.*
*Tellina donacina, *Linn.*
Astarte triangularis, *Mont.*
* — fluctuatus, *Carpenter.*
Miodon prolongatus (Cardita corbis).
*Lucina borealis, *Linn.*
Cryptodon flexuosus, *Don.*
Verticordia novem-costata (?).
Kellia suborbicularis, *Mont.*
Lasœa rubra (?), *Mont.*
Arca tetragona, *Poli.*
*Arca lactea, *Linn.*
Mytilus edulis, *Linn.*
Modiola modiolus, *Linn.*
Modiolaria marmorata, *Forb.*
Lima subauriculata, *Mont.*
Hinnites giganteus (?), *Gray.*
*Erato columbella, *Carpenter.*
Cerithiopsis tubercularis, *Mont.*
Cerithium adversum, *Mont.*
*Eulima micans, *Carpenter.*
*Solariella peramabilis (?), *Carpenter.*
Margarita Vahlii (?), *Möll.*
*Galerus sinensis, *Linn.*
Cylichna cylindracea, *Pennen.*
— mammillata, *Phil.*

Red Crag Species.

Rhychonella psittacea.
Macoma inquinata.
Astarte compressa.
Cardium Groenlandicum.
Nucula tenuis.
Acila castrensis (?).
Leda minuta.
Yoldia lanceolata.
Bela fidicula.
— excurvata.
Purpura saxicola (?).
Lacuna vincta.
Natica clausa.
Velutina lævigata.
Dentalium Indianorum.

Any inferences which might be drawn from the identifications of Dr. P. Carpenter in the case of the Pacific shells, and of Sir Chas. Lyell in the case of the United States

[1] *East* Pacific coast (*i.e. west* coast of America) is probably intended.

Medial Tertiary shells, depends upon the correctness of the identifications themselves, and this I have not had the means of examining.

A list of extraneous fossils was given by myself in a paper published in the 'Quart. Journ. Geol. Soc.,' 1859, but this would now require to be much added to. These are, however, undoubted derivatives, but I have been greatly embarrassed with specimens that do not belong, so far as I know, to any described species, and to which a strong suspicion attaches that they come from some older Tertiary formation. In such cases, as well as in those of known older Tertiary species, where the mineral condition of the specimen does not of itself indicate that it is derivative, I have figured the specimens, but in the synoptical list which follows I have distinguished all such as clearly derivative. There are besides these many shells in the Red Crag which I am disposed to regard as only present in that formation as derivatives.[1] The number of these is greater than was the case when the 'Crag Mollusca' left my hands in 1856, and I have distinguished them in the list as possibly or probably derivative. In one instance I have been compelled to regard as a genuine fossil of the period what I had before treated as derivative. This is *Voluta Lamberti*. In other instances, such as *Cassidaria bicatenata* and *Trophon elegans*, which were then only known from the Red Crag, I have satisfied myself not only that they are Cor. Crag species, but that their presence in the Red is due only to derivation. The only part of the Red Crag which is genuine and free from derivatives is that of Walton Naze (where *Voluta Lamberti* that I had wrongly regarded as derivative does occur), all the rest of the formation being more or less leavened with derivatives from the Coralline Crag, and from older formations, as well as with shells from older beds of Red Crag age, such as Walton, as explained at page vii of the Introduction to this Supplement. It is unfortunate that we get only this one deposit of Walton with a genuine fauna, since from the change in climate and consequent introduction of many northern forms into the newer parts of the Red Crag (as explained in the Introduction) the Walton fauna, though genuine, does not show what was the true fauna during the *later* stages of the Red Crag formation.

The elimination from the Red Crag fauna of the additional derivatives from the Coralline tends to increase the Palæontological distinction between those deposits, while on the other hand the discovery, since the 'Crag Mollusca' left my hands, of some few Coralline Crag species among the genuine Red Crag fauna pretty well balances this increment. I, however, see no reason to modify the opinion I have always entertained as to the complete separation of the Coralline and Red Crags, although the fauna of the oldest part of the Red Crag has a greater Mediterranean affinity than that of the newer, as pointed out by me in the 22nd volume of the 'Quarterly Journal of the Geological Society,' p. 542. With respect, however, to the Red and Fluvio-marine Crags, and their overlying Chillesford clay and sand, they can, in my opinion, be regarded as only one deposit, constituting in England the upper Crag, as the Coralline does the lower; and the triple

[1] The phosphatic nodule excavation in the Red Crag at Waldringfield is quite a museum of derivatives.

division of the Crag, which has for so many years been assumed, must, in my opinion, be abandoned. The Palæontological difference between the Walton bed and the newest part of the Red Crag, the *Scrobicularia* portion, or even the Butley portion, is far greater than any which exists between these latter and the Fluvio-marine Crag or Chillesford beds; and whether, as discussed at pp. ix and x of the Introduction to this 'Supplement,' the Fluvio-marine Crag of Bramerton (and, of course, the deposits at the other Fluvio-marine Crag localities of Suffolk and Norfolk also) be coeval with the newer part of the Red Crag, or posterior to it, it is sufficiently clear that, from the oldest or Walton Red Crag deposit up to the Chillesford clay itself, all the beds of the English Crag which are posterior to the Coralline are portions of the same geological formation, during the accumulation of which only very slight oscillations in the relative position of the sea and land occurred.

The synoptical list which follows these remarks will show what species of Mollusca have occurred in the Fluvio-marine Crag that have not yet been detected in the Red. With three or four exceptions these are shells that from their minuteness or fragility would only be preserved under exceptional circumstances in so roughly accumulated a deposit as the Red Crag, and their not having been detected in that formation need not surprise us. The most important among these three or four exceptions is the arctic species, *Astarte borealis*, which occurs sparingly in the Fluvio-marine Crag of Bramerton, but is common in the Chillesford bed at the same place, as well as in all the successive glacial deposits. It is, however, significant that while thus common in the Chillesford bed where it overlies the Fluvio-marine Crag, this shell has not been detected in these same Chillesford beds where they overspread the Red Crag; thus indicating, apparently, that its absence from the Red Crag was due to a localisation of the species rather than to any difference in age between the two deposits. The occurrence of a bed of land and freshwater shells in the Red Crag at Butley has, in my opinion, no bearing upon the question of the synchronism between the Red and Fluvio-marine Crags, but is due to the causes referred at p. 4 of this 'Supplement.'

I have not attempted to correlate the British Crag beds with the Crag of Antwerp, or with the Monte Mario, or Sicilian formations, because I feel satisfied that unless I had the means of comparing the specimens themselves from those formations with my own specimens from the English beds, any results that might be published would be more or less illusory. It is not sufficient for reliable identification to look over collections abroad; the specimens from the respective formations must be placed side by side and compared with each other. For this purpose extensive collections from these foreign beds would require to be made; and as I have not the opportunity at my advanced years of forming such, I have thought it best to leave the task of making a satisfactory correlation to other observers. I have therefore confined my tabular lists to the successive beds of the Crag, the Glacial, and Post-glacial series in that portion of England to which I have confined this Supplement, having had the means, except in the few cases expressly mentioned in the

work, of comparing all the specimens and of giving them deliberate examination. The Bridlington species have been examined by me either in the collection of Mr. Bean, now in the British Museum, or by means of specimens kindly supplied me for the purpose by Mr. Leckenby, to whom my best thanks are due for his obliging readiness at all times to assist me with specimens. The Burgh, Horstead, and Coltishall specimens, and those from the Lower and Middle Glacial deposits, have all been sifted out by my son under my own eyes from material obtained from time to time from the various localities by Mr. Harmer, and most carefully guarded against intermixture or the possibility of the intrusion of any other material or of specimens from any other place. The March and Hunstanton specimens have all been examined by me in collections made by Mr. Harmer from those places, and the Nar Valley specimens in the collection of the late Mr. Rose. The Kelsea Hill species are principally given on the authority of Mr. J. Gwyn Jeffreys, my son's collection from that place comprising only a portion of the species enumerated by that gentleman. My best thanks are due to Mr. Dowson and Mr. W. Crowfoot for the opportunity of examining the Aldeby specimens, to Mr. Cavell for the sight of specimens from the Cor. Crag near Orford, from Thorpe by Aldborough, and from Easton Cliff, and to Mr. Reeve for specimens from Bramerton. Especially to Messrs. Alfred and Robert Bell for the use of numerous specimens, and to the Rev. H. Canham, of Waldringfield, for his unwearied researches in both the Red and Coralline Crags, are my thanks due. I am also obliged to Dr. Reed, of York, for the use of many specimens which he possesses from the different Crags of Suffolk, as well as to Mr. E. Charlesworth, who has throughout his life taken so active a part in the elucidation of the natural history of the Crags. I must also express my thanks to Mr. Jeffreys for his readiness at all times to assist me with the loan of recent shells in his possession for the purpose of comparison. I have also had the assistance of my son throughout the preparation of this Supplement, and in the re-examination and revision to which I have subjected the determination of all the species given in the 'Crag Mollusca.' In all the instances where not otherwise specified in the text the specimens are from my own collection, and of my own finding.

In conclusion, I would add that I have studiously abstained from recognising the terms "Quaternary" or "Post-Tertiary." Of the terms "Primary," "Secondary," and "Tertiary," adopted by early geologists for great geological divisions, the first has become wholly obsolete. The term "Secondary" becomes yearly more and more vague, and less and less used to define any natural division of geological time; while the term "Tertiary" alone remains convenient in consequence of the yet unbridged chasm which separates the beds of that division from the Cretaceous group. To introduce, however, into geology another division as "Quaternary" or "Post-Tertiary" is not merely to import a term as unmeaning as that of "Primary," which has been universally dropped, but one whose limits cannot be defined by any constant feature, either in physical geology or in palæontology; and it finds a foil when some of our leading naturalists insist, as they have been lately doing, that we are still in the Cretaceous period. If we

test these terms "Quaternary," or "Post-Tertiary," by such a standard as that of the reference of those beds in which species not known living occur to the "Tertiary" group, and of those beds which contain none but living species to the "Quaternary," the standard will vary according to what forms of life we select. If we take the Mollusca, we find that a proportion of them not known as living occur in the Lower and Middle Glacial sands, and that, even in the Bridlington Bed, there are two such; so that if the division between Tertiary and Quaternary were based upon Molluscan evidence, we should have to draw the line just above the Bridlington horizon and below that of the Scotch beds, for in the Scotch none but species still living on one side or other of the Atlantic are found. If, instead of this, we take the Mammalia, the line would have to be brought down to that much later period when the *Machairodus* and the extinct species of *Elephant, Rhinoceros*, and *Hippopotamus* died out. On the other hand, if the Quaternary or Post-Tertiary age were attempted to be made co-ordinate with the existence of man, we should not only be placing it in the most uncertain of all positions in consequence of our knowledge of the evidences of man's existence undergoing almost daily extension, but the line so regulated would differ equally from that based on the Molluscan evidence, and from that on the higher animals; the evidence yet obtained of man's existence not going back to those later glacial formations in which the Mollusca belong to species which are all living, but showing him, nevertheless, to have long existed coevally with the extinct Mammalia.

While this difficulty of making any consistent definition of the term is so obvious, we have, on the other hand, from the Older Crag upwards evidence, in the case of the Mollusca at least, of the most gradual transition from a period treated by all as Tertiary, when a considerable proportion of the species consisted of forms not known living, to the most recent beds in which the included remains, to whatever part of the animal kingdom they belong, are all those of living species.

I have therefore referred all formations anterior to the recent, to the Tertiary period,—a period which by long custom has become well known, and must, until our knowledge becomes extended, be retained as convenient; and which, in Europe at least, appears to be sharply defined by unmistakeable physical and palæontological features, though even in this quarter of the world future discoveries may not improbably eventually necessitate its abandonment.

At the end of the synoptical list which follows, the change which has taken place through the formations succeeding the Coralline Crag, from the Mediterranean aspect which the Mollusca of British seas possessed at the period of that Crag, is pointed out.

SYNOPTICAL LIST OF MARINE MOLLUSCA FROM THE UPPER TERTIARIES OF THE EAST OF ENGLAND.

N.B.—The references to the pages of the 'Crag Mollusca' are given in simple figures; those to the Appendix have the letter A prefixed, and those to the Supplement have the letter S prefixed.

PAGE.	GASTEROPODA.	Cor. Crag.	Red Crag, Walton.	Red Crag,* Sutton and Butley.	Scrobicularia Crag.†	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
14, s 4	Ovula spelta, *Linn.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	*Ovula Leathesii*, Crag Moll.
s 4	— — *var.* brevior	...	×	×	...	...	...	...	...	...	...	...	...	...	...	?	?	
16	Cypræa affinis, *Dujardin*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
15	— avellana, *J. Sow.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
16	— Angliæ, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only a variety of *retusa*.
16	— retusa, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
17, s 5	— Europæa, *Mont.*	×	×	×	...	...	...	...	×	...	...	...	...	...	×	×	×	
18	Erato lævis, *Donovan*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Probably only derivative in Red Crag. I cannot find anything to justify its insertion as a Fluvio-marine Crag shell.
19	— Maugeriæ, *Gray*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	One specimen only from Red Crag, and that probably a derivative.
A 310	Mitra ebenus, *Lam.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	Probably derivative in Red Crag. Given by Bell (Annals, May, 1871) from Waldringfield.
21, A 311	— — *var.* plicifera	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	
s 7	— — *var.* uniplicata	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	?	
s 8	— fusiformis, *Broc.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Waldringfield only, and derivative.
20, s 7 & 173	Voluta Lamberti, *J. Sow.*	×	×	×	...	×	...	...	...	...	...	...	...	...	...	...	...	
s 7	— (Volutilithes) luctatrix, *Solander*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Waldringfield only, and derivative.
s 6	— — nodosa, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Waldringfield only, and derivative.
s 6	Ancillaria glandiformis, *Lam.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Waldringfield only, and derivative.
26, s 8	Terebra canalis, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
	— — *var.* acuminata	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*T. exilis ?* A. Bell.
26	— inversa, *Nyst*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 9	Columbella (Astyris) Holbollii, *Moll.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	Living in Greenland seas.
s 174	— Borsoni ? *Bellardi*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A doubtful identification.
23, s 9	— sulcata, *J. Sow.*	×	×	×	...	?	...	...	...	...	...	...	...	...	...	...	...	*Columbella scripta* I have not seen from the Crag, nor *C. abbreviata* either.
s 174	— minor, *Scacchi*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
27, s 11	Cassidaria bicatenata, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
s 11	— — *var.* ecatenata	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 10	Cassis Saburon, *Brug.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	Waldringfield only, and derivative in Red Crag.
32, s 15	Nassa conglobata, *Broc.*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
31	— consociata, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
s 13	— densecostata, *A. Bell*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
30	— elegans, *Leathes*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 11	— granifera, *Dujardin*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
29, s 12	— granulata, *J. Sow.*	×	×	×	...	...	...	...	×	...	...	...	...	...	...	...	?	Living in Japanese seas. Sec. A. Bell in lit.
29, s 12	— incrassata, *Müll.*	×	...	×	...	...	×	...	×	...	...	...	...	×	×	×	×	
28, s 15 & 176	— labiosa, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
31, s 15, A 315	— Monensis, *Forbes*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	An uncertain species.

* The column of Sutton and Butley includes all the Red Crag localities except Walton and the Scrobicularia Crag, all such being regarded as newer than the Walton and older than the Scrobicularia beds. The Bentley Crag, however, seems very nearly identical with that of Walton.

† The paucity of species in this column does not arise altogether from the paucity of species in the Scrobicularia Crag, but from its not having been searched in the way that the other beds of the Red Crag have been. I have no doubt that by investigation the names in this column might be much augmented.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
32	Nassa prismatica, *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	The true *prismatica* of Brocchi sent to me by Mr. Canham since Supplement in type.
	— — *var.* limata	×	×	×	...	...	...	...	...	...	...	...	...	...	...	?	?	
30, s 13	— propinqua, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	*trivittata* ? Say.
s 14 & 176	— Cuvieri, *Payr.*	...	...	×	...	×	...	...	×	...	...	...	...	...	...	×	×	*N. pusillina* of Supplement to Crag Mollusca.
s 13	— pulchella, *Andr.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Red Crag, Waldringfield (Bell); probably only derivative in Red Crag.
A 315, s 12	— pygmæa, *Lam.*	?	...	?	...	...	...	...	...	...	...	...	...	×	×	×	×	
33, s 15	— reticosa, *J. Sow.*, and numerous varieties.	...	×	×	...	...	×	...	...	...	...	...	...	...	...	...	...	As to *Nassa musiva*, see Sup., p. 176.
s 14, A 315	— reticulata, *Linn.* — — *var.* nitida	...	...	...	...	...	...	...	...	...	×	...	×	...	×	×	×	
24, s 5	Rostellaria lucida, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*plurimacosta*, Crag Moll.
42, A 311, s 10	Pyrula reticulata, *Linn.*	×	?	...	...	...	...	...	...	...	...	...	...	...	...	...	?	Probably derivative in the Red Crag.
34, s 16	Buccinum Dalei, *J. Sow.*	×	×	×	...	×	×	...	...	...	...	...	...	...	×	...	×	
s 17	— pseudo Dalei, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 17	— glaciale, *Linn.*	...	×	?	...	...	...	...	...	...	...	...	...	...	...	...	×	
s 175	— Tomlinei, *Canham*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative only.
35, s 18	— undatum, *Linn.*	×	?	×	...	...	...	...	...	?	×	...	...	×	×	...	×	Locality of Cor. Crag omitted accidentally at Supplement, p. 35.
35, s 18	— — *var.* tenerum	...	×	×	...	×	×	...	×	...	...	×	×	...	...	...	×	Hunstanton since Supplement printed off.
35	— — *var.* striatum, *Pennant*	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	...	
s 18	— — *var.* Groenlandicum, *Chemn.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	
s 18	— — *var.* clathratum, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 18	— — ? ovulum, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Perhaps only a distortion of *undatum*.
36, s 18	Purpura lapillus, *Linn.* (crispata)	...	×	×	×	×	×	×	×	×	×	×	...	...	×	...	...	
36, s 18	— incrassata, *J. Sow.*	...	×	×	...	×	...	...	×	...	...	...	...	...	×	...	×	
38, s 29 ?	— tetragona, *J. Sow.*	...	×	×	...	?	...	...	...	...	...	...	...	...	...	...		Given from Norwich in Woodward's list; *sed quæ.*
s 175	Lachesis anglica, *A. Bell*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 176	Murex insculptus ?	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative only.
s 30	— corallinus, *Scac.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 30	— Canhami, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Unique and possibly derivative.
39, s 31	— erinaceus, *Linn.*	...	...	×	...	×	...	...	...	...	×	...	...	...	×	×	×	
40	— tortuosus, *J. Sow.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Fossil in the Vienna beds. Hörnes' Tab. XXV, fig. 12.
41, s 30	Triton connectens, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*heptagonus*, Crag Moll.
49	Trophon alveolatus, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Possibly only derivative in Red Crag.
49	— consocialis, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Possibly only derivative in Red Crag.
s 25	— Actoni, *S. Wood*	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	
44, s 19	— (Neptunea) antiquus, *Linn.* — — *var.* striatus	...	...	×	×	×	×	×	×	...	...	...	...	...	×	...	×	
44, s 19	— — *var.* striatus contrarius	...	×	×	?	×	×	×	?	...	...	...	...	...	×	...	×	
44, s 19	— — *var.* carinatus	...	...	×	...	?	...	...	...	×	...	...	...	...	...	...	×	
44, s 19	— — *var.* carinatus contrarius	...	...	×	...	×	...	...	...	×	...	...	...	...	...	...	×	
s 21	— Berniciensis ? *King*	...	...	...	...	×	...	...	...	...	...	...	...	...	×	...	×	*Spitzbergensis* of Woodward's list.
48	— costifer, *Nyst.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	?	*Costatus*, J. Sowerby. *Fusus Mitgaui ?* Könen.
46, s 22, 98, & 177	— (Atractodon) elegans, *Charlesworth*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in the Red Crag.
47, s 23	— (Tritonofusus) altus, *S. Wood*	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	
46, s 24	— (Sipho) gracilis, *Da Costa*	...	...	×	...	?	...	...	...	×	...	...	...	...	×	...	×	Given in Woodward's list as from Norwich.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
s 24	Trophon (Sipho) Jeffreysianus, *Fischer*	...	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
A 312, s 21 & 177	— (Strombella) Norvegicus, *Chemn.*	...	...	×	...	?	...	...	...	...	...	...	...	...	×	...	×	Given in Woodward's list as from Norwich.
s 23	— (Sipho) Sabinii, *Gray*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	
s 25	— — Sarsii, *Jeffreys*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	
A 313, s 24	— — propinquus, *Alder*	×	×	×	...	...	...	...	...	×	...	...	...	...	×	...	×	Given from Bridlington by Woodward.
A 312, s 22	— Turtoni, *Bean*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	...	×	
s 22	— ventricosus? *Gray*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	
s 27, A 314	— Barvicensis, *Johnston*	...	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Walton, *fide* Bell. 310 fathoms off Malta, 'Depths of the Sea,' p. 270.
s 25, A 313	— craticulatus, *Fabr.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	*Fabricii?*
s 28	— mediglacialis, *S. Wood*	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	
s 28	— Billockbiensis, *S. Wood*	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	*Murex erinaceus*, juv. ?
48, s 26	— scalariformis, *Gould*	...	...	×	...	×	...	...	×	×	×	×	...	...	...	...	×	Obtained from March since Supplement printed.
s 27	— Gunneri, *Lovén*	...	...	...	...	...	...	...	...	×	×	...	...	...	...	...	×	
50, s 28	— muricatus, *Mont.*	...	×	×	...	...	...	...	×	...	...	...	...	...	×	×	×	
s 26, A 314	— Bamffius, *Mont.*	...	...	...	...	...	...	...	...	...	×	×	...	...	×	...	×	At page 321 of vol. iv of Brit. Con. this shell, under the synonym of *truncatus*, is given from the Norwich and Red Crags, but the author of that work has omitted it from the list in Quart. Journ. Geo. Soc., vol. xxvii, p. 492.
51	— gracilius, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Possibly the young of *Pleurotoma attenuata.*
s 24	— Leckenbyi, *S. Wood*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	
A 314, s 29	Fusus crispus, *Borson*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
s 29	— abrasus, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
50, s 29	— imperspicuus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	As to *Fusus despectus* and *F. Largillierti*, see Sup., pp. 177-8.
54, s 34	Pleurotoma modiola, *Jan.*	×	×	...	...	...	...	...	...	...	...	...	...	...	?	...	...	*carinata*, Crag Moll. Said to have been dredged off the Irish Coast in 110 fathoms, 'Depths of the Sea,' p. 86.
s 179	— Bertrandi? *Phil.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	
s 35	— crispata, *Jan.* — — *var.* papillosa	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
53, s 32	— intorta, *Broc.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	?	Probably only a derivative in Red Crag.
s 32	— interrupta, *Broc.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
55, s 33	— inermis, *Partsch*	×	...	...	...	...	...	...	...	...	...	...	...	...	?	...	?	*nivalis?* Lovén, *porrecta*, Crag Moll.
s 33	— nodifera, *Lam.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
s 34	— Tarentini, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
53, s 33	— turrifera, *Nyst*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
54, s 36	— bipunctula, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
54, s 35 & 180	— Icenorum, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
s 32	— coronata, *Bellardi*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only derivative in Red Crag.
s 40	— assimilis, *S. Wood*	...	...	×	...	...	...	...	×	...	...	...	...	...	...	...	...	
s 38	— attenuata, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 43	— bicarinata, *Couth.*	...	...	×	...	?	...	...	...	...	...	...	...	...	...	...	×	By Mr. Reeve from Bramerton, but I have not seen the specimen.
60	— (Raphitoma) brachystoma, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	...	
61	— cancellata, *J. Sow.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*reticulata?* Ren.
57	— castanea, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 36	— elegantula, *A. Bell*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
58	— costata, *Dacosta*	×	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 37	— (Conopleura) crassa, *A. Bell*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 38	— elegantior, *S. Wood*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	?	
s 44	— equalis, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
61, s 42	— hispidula, *Jan.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	*concinnata*, var., Crag Moll. Atlantic, in 358 to 717 fathoms, 'Depths of the Sea,' p. 181.
s 41	— hystrix, *Jan.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
56 } s 36 }	Pleurotoma linearis, *Mont.*	×	...	×	...	...	×	...	×	...	...	...	...	...	×	×	×	
62 } s 42 }	— lævigata, *Phil.*	?	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
63	— Leufroyii, *Michaud*	...	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	{ *Boothii*, Crag Moll. Given by Mr. Jeffreys from Sutton, but I only know it from Walton.
59	— mitrula, *J. Sow.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	?	...	*Vauquilini*? Payr.
s 39	— Dowsoni, *S. Wood*	...	...	...	...	...	×	...	?	×	...	...	...	...	...	...	...	
s 40	— robusta, *S. Wood*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	
s 45	— nebula, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 45	— nebulosa, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
58	— perpulchra, *S. Wood*	×	×	..	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Given from Walton by Mr. Bell, Ann. and Mag. Nat. Hist. for May, 1871.
s 43 }	— (Bela) pyramidalis, *Strom.*	...	...	×	...	×	...	...	...	×	×	×	...	...	...	...	×	
64 } s 39 }	— plicifera, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	?	?	
s 178	— clathrata, *M. de S.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
57	— Philberti, *Mich.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	{ Given from Walton by Mr. Bell, Ann. and Mag. Nat. Hist. for September, 1870.
s 44	— quadricincta, *S. Wood.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 44	— rufa, *Mont.*	...	...	?	...	?	...	...	...	...	...	×	...	...	×	...	...	
s 39	— scalaris, *Möll.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	*Pl. harpularia*? Couthouy.
s 38	— septangularis, *Mont.*	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	...	
s 42	— senilis, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
62 } s 41 }	— tenuistriata, *A. Bell*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
51 } s 27 }	— teres, *Forbes*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*Trophon paululum* of Crag Moll.
s 178	— tereoides, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 46 } & 179 }	— striolata, *Phil.*	×	...	?	...	...	...	...	...	...	...	...	...	...	×	×	×	{ It is given by Mr. Jeffreys from the Red Crag, Shottisham, but I have not seen the specimen.
63	— Trevelyana, *Turt.*	...	...	×	...	×	×	...	...	...	...	...	...	...	×	...	×	Chillesford Bed, Horstead.
62 } s 40 }	— turricula, *Mont.*	...	×	×	...	×	×	...	×	×	×	×	...	...	×	...	×	As to *P. pygmæa* and *P. oblonga*, see Sup., p. 180.
s 45	— violacea? *Migh. & Ad.*	...	...	?	...	...	...	...	...	...	...	...	...	...	...	...	×	As to *P. rugulosa*, see Sup., pp. 46 and 179.
s 48	Cancellaria cancellata, *Linn.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	
s 46	— contorta, *Bast.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
s 48	— ? Charlesworthii, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Waldringfield only, and derivative.
64	— coronata, *Scacchi*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
67 } s 47 }	— Bellardi, *Mich.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
67 } s 48 }	— Bonellii, *Bellardi*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
65	— mitræformis, *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	Probably derivative in Red Crag.
s 49 } & 182 }	— spinulosa? *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
A 316	— scalaroides, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 182	— umbilicaris? *Broc.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
s 46 }	— (Admete) gracilenta, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
66 } s 47 }	— — subangulosa, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Admete Reedii*, A. Bell.
66 } s 97 }	— — viridula, *Fab.*	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	×	*C. costellifera* of Crag Moll.
s 97	— — — *var.* Couthouyi	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	
s 50 }	Cerithium (Bittium) aberrans, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
71	— cribrarium, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
71	— Metaxa, *Delle Chiaje*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
72 } s 50 }	— perpulchrum, *S. Wood*	×	...	...	..	...	...	...	...	...	...	...	...	...	...	?	...	*C. mammillatum*? Risso.
69 } s 51 }	— tricinctum, *Broc.*	×	×	×	...	×	×	...	×	...	...	...	...	...	...	...	...	
69	— variculosum, *Nyst*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 50	— reticulatum, *Da Costa*	...	?	...	...	...	...	...	...	...	...	...	...	×	×	×	×	
72 } s 181 }	— perversum, *Linn.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	{ *C. adversum* of Crag Moll., Red Crag, Walton. Bell, Ann. and Mag., September, 1870.
70	— trilineatum, *Phil.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	{ Walton, according to Bell, Ann. and Mag., September, 1870.
73	— granosum, *S. Wood*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ *C. Macandreæ* is said to have the ridges plain, whereas *granosum* is granulated.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
s 52	Cerithiopsis lactea ? *Möller* ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	
70 s 52 & 181	— tubercularis, *Mont.*	×	...	×	...	×	...	...	×	...	...	...	...	...	×	×	×	Derivative in Red Crag.
s 181	— — *var.* subulatus.........	×	...	...	...	...	...	...	...	...	...	...	...	...	×	?	?	*C. Barleei*, Jeff.
s 181	— — *var.* nanus	×	...	...	...	...	...	...	...	...	...	...	...	...	×	?	?	*C. pulchella*, Jeff.
25 s 49	Aporrhais pespelicani, *Linn.* ...	×	×	×	...	×	...	...	...	...	...	×	...	×	×	×	×	Walton omitted accidentally as a locality in Supplement.
s 180	— — *var.* Serresianus......	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
67	Trichotropis borealis, *Brod. & Sow.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	Tab. VII, fig. 17, of Crag Mollusca.
67	— insignis, *Midd.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	Tab. XIX, fig. 11, of Crag Mollusca; living, Behring's Strait.
88	Litiopa ? papillosa, *S. Wood* ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 57	Menestho lævigata, *S. Wood* ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Menestho albula*, from the Red Crag, I do not know. See page 185 of Supplement as to *M. Jeffreysii*.
s 185	— Britannica, *A. Bell*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
75	Turritella imbricataria, *Lam.* ...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in the Crag.
76 s 54	— planispira, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	
75 s 52	— incrassata, *J. Sow.*.........	×	×	×	×	×	...	...	×	...	...	...	...	...	...	×	×	*T. triplicata*, Broc.
75 s 54	— — *var.* vermicularis ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	
75 s 54	— — *var.* bicincta	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	
74 s 53	— terebra, *Linn.*...............	...	...	?	...	×	×	...	×	×	×	×	...	×	×	×	×	*T. communis* of Crag Mollusca.
76 s 53	— (Zaria) erosa, *Couth.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	*T. clathratula* of Crag Mollusca.
s 53	— ? penepolaris, *S. Wood* ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 183	Scalaria communis, *Lam.*.........	...	...	...	...	...	...	...	...	...	...	×	...	...	×	×	×	
94	— clathratula, *Adams*	×	...	...	...	?	...	...	...	...	...	...	...	...	×	×	×	Given in Woodward's list as from Norwich; *sed quæ.*
93	— foliacea, *J. Sow.*...........	×	...	×	...	?	...	...	...	...	...	...	...	...	...	...	...	Not improbably derivative in Red Crag. Said in Woodward's list to occur in fragments at Norwich; *sed quæ.*
92 s 59	— frondosa, *J. Sow.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	*S. soluta* ? Tiberi. Mediterranean, 30 to 250 fathoms, 'Depths of the Sea,' p. 192.
91	— fimbriosa, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
92 s 59	— frondicula, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
90 s 59	— Grœnlandica, *Chemn.*......	...	...	×	...	×	×	×	×	×	...	...	...	...	×	...	×	
91	— hamulifera, *S. Wood*......	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
90 s 98	— funiculus, *S. Wood*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*S. varicosa* of Crag Moll.
93 s 98	— subulata, *J. Sow.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	Given by Mr. Bell from Walton, Ann. and Mag., September, 1870.
94 s 58	— Trevelyana, *Leach*.........	...	...	×	...	×	×	...	×	...	...	...	...	...	×	×	×	
s 58	— Turtonis, *Turton*	...	...	...	...	...	×	...	...	...	...	...	...	...	×	×	×	
95 s 59	— ? cancellata, *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
95	— ? obtusicostata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
s 98 & 183	— semicostata, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
77 s 57 & 182	Pyramidella læviuscula, *S. Wood*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
80	Chemnitzia (Turbonilla) costaria, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	?	...	Red Crag, Butley, A. Bell, Ann. and Mag., 1870, but probably only derivative there.
81 s 60	— — elegantior, *S. Wood* .	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*C. elegantissima* of Crag Moll.
82 s 60	— — filosa, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	*Parthenia varicosa*, Forbes ?
83	— — perexilis, *S. Wood* ...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*C. unica* of Crag Moll., but as it does not seem to belong to Montague's species I have assigned it a new name.
82	— — densecostata ? *Phil.*..	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
s 184	— — Jeffreysii, *Wiechman*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A doubtful identification.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
s 59	Chemnitzia (Turbonilla) clathrata, *Jeff.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	...	
81 s 60	— — internodula, *S. Wood*	×	×	×	...	×	...	...	×	...	...	...	...	...	...	×	×	
79	— — indistincta? *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
80	— — nitidissima? *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	The striæ are probably absent from wear.
71 s 60	— — rufa, *Phillipi*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
84	— — similis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*C. similis*, Forbes, of Crag Moll., Tab. X, fig. 11 *a*; an error.
84	— — varicula? *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
s 61	— — rugulosa, *S. Wood*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A provisional species.
s 61	— — plicatula? *Broc.*	...	×	×	...	...	×	...	...	...	...	...	...	...	...	...	...	
84 s 67	Eulimella acicula, *Phil.*	×	×	...	...	×	...	...	...	...	...	...	...	...	×	×	×	*Chemnitzia similis* of Crag Moll., fig. 11 *b* & *c*.
85 s 63	Odostomia conspicua, *Alder*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Var. β of *O. plicata* of Crag Moll., Tab. IX, fig. 3 *b*. (*O. acuta*, Jeffreys, var.)
85 A 317 s 63	— conoidea, *Broc.*	×	?	...	...	?	...	...	?	...	...	...	...	...	×	×	×	Var. α of *O. plicata* of Crag Moll., Tab. IX, fig. 3 *a*.
86	— pellucida, *Adams*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*O. decussata*, Mont.
s 62	— insculpta, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	
s 64	— obliqua, *Alder*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	...	
A 318	— truncatula, *Jeff.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	
s 63	— plicata, *Mont.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	...	Not *O. plicata* of p. 85, and Tab. IX, of Crag Moll.
s 185	— dentiplicata, *S. Wood.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
86	— chrysalis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*O. pupa* of Crag Moll., but as it is neither that shell nor *interstincta*, I propose for it a new name. There is a strong spiral ridge in the lower part of each whorl that is absent in both these species.
87 s 64	— ornata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*O. similima* of Crag Moll.
s 62	— ? Gulsonæ, *Clark*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	*Aclis Gulsonæ* of Jeff.
A 317 s 64	— unidentata, *Mont.*	...	×	...	...	...	...	...	?	...	...	...	...	...	×	...	×	
s 64 & 184	— albella, *Lovén*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Sardinia sec., Brit. Con.
98 s 67	Eulima glabella, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	
96 s 67	— intermedia, *Contraine*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Var. *vulgaris* of *E. polita* in Crag Moll., Tab. XIX, fig. 1 *a*.
96	— polita, *Linn.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Fig. 16 of Tab. XIX of Crag Moll.
s 65	— similis? *D'Orb.*	...	×	...	...	...	...	...	...	...	...	...	...	...	?	?	?	(*distorta*, Phil.), a doubtful identification.
s 65 & 184	— stenostoma? *Jeffreys*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	
97 s 66	— subulata, *Donov.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 66	— bilineata? *Alder*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	A doubtful identification.
99 s 55	Alvania supranitida, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*Alvania ascaris* of Crag Moll. *Aclis ascaris* I do not recognise in the Crag.
99 s 56	— — albella, *Leach*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*Aclis Walleri*, Jeff.
109 s 65	Eulimene pendula, *S. Wood*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
109 s 65	— terebellata, *Nyst.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative?
109 s 71	Hydrobia ulvæ, *Pennant*	...	...	...	...	×	×	...	...	...	...	...	...	...	×	×	×	Also in older Post Glacial bed, Gedgrave.
s 97	Rissoa abyssicola, *Forbes*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
104	— confinis, *S. Wood*	×	...	...	...	?	...	...	...	...	...	...	...	...	...	...	...	I do not know this shell from Bramerton, and as it has no distinguishing mark in the list to Mr. Prestwich's Red Crag paper (p. 490) it has probably got in there by some oversight.
107	— — *var.* supracostata	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*R. supracostata* of Crag Moll. I have treated this as a variety of *confinis*, because the absence of costæ from the lower whorl, which is its only distinction, is exhibited by more than one species of living *Rissoæ*.
106 s 73 & 185	— Stefanisi, *Jeff.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	?	?	*R. costulata* of Crag Moll. It is said to be living. *Menestho Jeffreysi*, A. Bell.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
106	Rissoa crassi-striata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
102, s 72 & 104	— curticostata, *S. Wood*	...	...	×	...	×	...	...	×	...	...	...	...	...	...	...	...	*R. semicostata*, Woodward (*non* Mont.), and *R. pulchella* of Crag Moll.
s 72	— eximia? *Jeffreys*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	
105	— obsoleta, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 71	— proxima, *Alder*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
103	— concinna, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*R. punctura* of Crag Moll. I there gave the reference to *punctura*, Mont., with a doubt; and as that doubt is confirmed by others, I have reverted to the name *concinna*, given in my Catalogue of 1842.
103, s 73	— reticulata? *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
100	— striata, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	I do not know this shell from any other than the Cor. Crag. It is given in the Red Crag list of Mr. Prestwich's paper (p. 491), but as no locality is inserted it has probably got in there by some oversight.
A 318	— soluta, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	?	×	?	
102	— vitrea, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
101	— Zetlandica, *Mont.*	×	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 73	— senecta, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	A doubtful species.
117, s 87	Cæcum glabrum, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 87	— liratum, *Carpenter*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
116, s 87	— mammillatum, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	?	Probably only derivative in Red Crag.
115, s 87	— trachea, *C. M.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	?	*C. tumidum*, Carp.
121, A 317	Fossarus sulcatus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
121, s 186	— lineolatus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Var *lineolatus* of *F. sulcatus* in Crag Moll.
316, s 80	Lacuna vincta, *Mont.*	...	...	...	...	×	...	...	...	...	×	×	...	...	×	...	×	*L. divaricata.*
s 80	— crassior	...	...	...	...	?	...	...	...	...	×	...	...	...	×	...	×	I do not know the species from the Fluvio-marine Crag, but it is given from Bramerton in Mr. Prestwich's Red Crag paper.
122, s 79	— reticulata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Genus *Macromphalus*, S. Wood.
120, s 80	— suboperta, *J. Sow.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
118, s 79	Littorina littorea, *Linné*	...	...	×	...	×	×	×	×	×	×	×	...	×	×	...	×	
118, s 79	— rudis, *Maton*	...	...	...	...	×	×	×	?	...	...	...	...	...	×	...	×	
s 78	Amaura candida, *Möll*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	Since Supplement was printed this has been found also by Mr. Crowfoot in the Red Crag of Boyton.
s 74	Natica Alderi, *Forbes*	×	...	...	...	×	...	...	×	...	×	×	...	×	×	×	×	It is given in Mr. Prestwich's Red Crag paper as from the Red Crag, but I have not yet seen it from there unless it be the shell called *N. Guillemini*, infrà.
142, s 76	— catena, *Da Costa*	...	...	×	...	×	×	×	×	×	...	...	...	...	×	×	×	
141, s 77	— catenoides, *S. Wood*	...	×	×	...	...	?	...	...	...	...	...	...	...	...	...	...	
147, s 75	— clausa, *Brod. & Sow.*	...	...	×	...	×	×	×	×	×	×	...	...	...	×	...	×	
145, s 76	— cirriformis, *J. Sow.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Not *N. heros*, Say.
146, s 75	— Grœnlandica, *Beck*	...	...	×	...	×	×	...	...	×	×	...	...	...	×	...	×	
142, s 74	— Guillimini, *Phil.*	...	...	×	...	...	...	...	...	...	...	...	...	...	?	?	?	Possibly *N. Alderi* or the young of *catenoides*.
145, s 78	— (Amauropsis) helicoides, *Johnson*	...	...	×	...	×	×	×	×	×	×	×	...	...	×	...	×	
144, s 75	— hemiclausa, *J. Sow.*	...	×	×	...	?	×	...	...	...	...	...	...	...	...	...	...	It is given in Mr. Prestwich's list from the Fluvio-marine Crag, Bulchamp, but I have not seen it.
s 74	— helicina, *Broc.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Red Crag of Bentley and Walton only.

PAGE.		Cor Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
148 s 76	Natica multipunctata, *S. Wood*	×	×	×	...	...	?	...	...	...	...	...	...	...	...	...	...	Not *millepunctata.*
143	— proxima, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	?	?	?	*N. sordida* ? Phil.
s 77	— pusilla, *Say*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	
146 s 76	— occlusa, *S. Wood*	...	...	×	...	...	×	...	...	×	...	...	...	...	...	...	×	
s 78	— Montacuti, *Forbes*	...	...	...	...	...	...	...	...	×	...	...	...	...	×	...	×	
143	— varians, *Dujardin*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
149	Sigaretus excavatus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
151	Marsenia tentaculata, *Linn.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
152	Velutina lævigata, *Pennant*	...	...	...	...	×	...	...	...	...	...	...	...	...	×	...	×	
153	— undata, *J. Smith*	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	×	
153	— virgata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
113	Vermetus intortus, *Lam.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	*V. subcancellatus*, Phil., T. IX, fig. 20. Probably only derivative in Red Crag.
114	— Bognoriensis	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative from Eocene.
	— ? triqueter, *Bivonæ*	?	...	?	...	...	...	...	...	...	...	...	...	...	...	?	...	It is doubtful whether the specimens be not Annelids of the genus *Vermilia.*
129	Trochus Adansoni, *Payr.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Probably only derivative in Red Crag.
128	— villacus ? *Phil.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Probably only derivative in Red Crag.
130	— — Kicksii ? *Nyst*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably only a var. of *Adansoni*, and derivative in Red Crag.
s 82	— bullatus, *Phil.*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
131 s 81	— cinerarius, *Linn.*	...	×	×	...	...	...	...	×	...	...	×	...	...	×	×	×	
131	— cineroides, *S. Wood*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
125	— conulus, *Linn.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	?	
133	— ditropis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
125	— formosus, *Forbes*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	...	×	*T. alibastrum*, Beck ; *T. occidentalis*, Migh.
127	— millegranus, *Phil.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Red Crag, Walton, *fide* Bell, Ann. and Mag. Nat. Hist., 1871.
127	— multigranus, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	?	Cor. Crag, *fide* Bell, Ann. and Mag., 1871.
129	— Montacuti, *W. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Possibly only derivative in Red Crag.
126 s 81	— noduliferens, *S. Wood*	...	×	×	...	×	...	...	?	...	...	...	...	...	...	...	...	*T. papillosus* of Crag Mollusca.
133	— obconicus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 81	— granulatus, *Born*	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
126	— sub-excavatus, *S. Wood*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Possibly a variety of *noduliferens.*
132	— tricariniferus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 80	— turgidulus ? *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
130	— tumidus, *Mont.*	...	...	×	...	×	×	...	...	...	...	...	...	...	×	×	×	
124 s 81	— zizyphinus, *Linn*	×	...	×	...	?	...	...	?	...	...	...	...	...	×	×	×	
123 A 321	— crenularis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Spurious.
134	Margarita elegantissima, *Bean*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	Living, Greenland and Spitzbergen.
s 84	— argentata, *Gould*	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	×	
s 83	— Groenlandica, *Chemn.*	...	...	...	...	×	...	...	?	...	...	...	...	...	×	...	×	
135 s 83	— maculata, *S. Wood*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	One small specimen from the Red Crag at Walton is in my cabinet.
136 s 84	— trochoidea, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
139 s 84	Adeorbis pulchralis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
137 s 84	— striatus, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
139	— subcarinatus, *Mont.*	×	×	×	..	...	...	...	...	...	...	...	...	...	×	×	×	
137 s 84	— supranitidus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
138 s 84	— tricarinatus, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 85	Solarium vagum, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative.
s 86 & 186	Cyclostrema lævis, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	?	*C. basi-striatum ?*
122 s 86	— ? sphæroidea, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	*Turbo sphæroidea* of Crag Moll.
s 86	Homalogyra atomus, *Phil.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
163	Scissurella crispata, *Flem.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
168	Fissurella græca, *Linn.*	×	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 90	— costaria, *Grateloup*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Probably derivative in Red Crag.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
166 s 91	Cemoria (Puncturella) Noachina, *Linn.*	...	...	...	...	...	...	...	...	×	...	...	...	...	×	×	×	Recently found in Mediterranean, Brit. Con., vol. v, p. 200.
165 s 90	Emarginula crassa, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Recently found in Mediterranean, Brit. Con., vol. v, p. 200.
	— — *var.* crassalta	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
164 s 89	— fissura, *Linn.*	×	×	×	...	...	...	...	?	...	...	...	...	...	×	×	×	
s 89	— — *var.* rosea, *Bell.*	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
	— — *var.* elongata	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
159 s 89	Calyptræa Chinensis, *Linn.*	×	×	×	...	×	×	...	×	...	...	...	...	...	×	×	×	
155 s 88	Capulus Ungaricus, *Linn.*	×	×	×	...	?	...	...	×	...	...	...	...	...	×	×	×	
156 s 88	— (Brocchia) partim sinuosus, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Doubtful species. Figs. 3 *a, b*, of Tab. XVII of Crag Mollusca.
s 88	— — sinuosus, *Broc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Doubtful species.
156 s 88	— recurvatus, *S. Wood*	×	×	×	...	...	...	...	...	...	...	...	...	...	×	×	...	Fig 3*f*, of Tab. XVII, of Crag Moll.
156	— obliquus, *S. Wood*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Cor. Crag, *fide* Bell, Ann. and Mag., 1870.
157	— fallax, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
161	Tectura virginea, *Müller*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Found by myself in Cor. Crag at Sutton since Crag Mollusca published.
161 s 91	— fulva, *Müller*	×	?	...	...	...	...	...	×	...	...	...	...	...	×	...	×	
162 s 91	— parvula, *S. Woodward*	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	A doubtful species, possibly the young of *Patella vulgata.*
183	Patella vulgata, *Linn.*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	The Fluvio-marine Crag shell is that called *T. parvula.*
189 s 93	Dentalium abyssorum, *Sars*	...	...	...	...	...	...	...	...	×	...	...	...	...	×	×	×	Fig. 2 of Tab. XX of Crag. Moll., as *D. entale* from Bridlington.
188 s 92	— dentalis, *Linn.*	×	...	×	...	...	...	...	×	...	...	...	...	...	...	×	×	Probably derivative in Red Crag.
s 92 & 187	— entalis, *Linn.*	×	...	...	...	...	...	...	...	...	×	...	...	...	×	×	×	Not the *entale* of Crag Moll., which is *D. abyssorum.*
s 92	— rectum, *Linn.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	?	...	Probably derivative in Red Crag.
190	— bifissum, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	?	*G. Dischides*, Jeff.
s 95	Chiton discrepans ? *Brown*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
185	— fascicularis, *Linn.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
186 s 95	— Hanleyi, *Bean*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*C. strigillatus* of Crag Moll.
186 s 95	— Rissoi, *Payr*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
22 s 96	Ringicula buccinea, *Broc*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	Derivative in Red Crag.
22 s 97	— ventricosa, *J. Sow.*	×	...	×	...	×	×	...	...	...	...	...	...	...	...	×	×	
169 s 93	Actæon Noæ, *J. Sow*	...	×	×	...	?	...	...	...	...	...	...	...	...	...	...	...	
171 s 94	— levidensis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
170 s 94	— subulatus, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
170 s 93	— tornatilis, *Linn.*	×	...	×	...	×	×	...	...	...	...	...	...	...	×	×	×	
s 94	— ? Etheridgii, *A. Bell*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	
s 187	Bulla (Cylichna) utriculus, *Brocc.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
176	— alba, *Brown*	...	...	...	...	×	...	...	...	...	...	...	...	...	×	...	×	*B. cylindracea*, var., Tab. XXI, fig. 1 *b*, of Crag Mollusca. *Volvaria alba*, Brown.
174 A 322	— (Volvula) acuminata, *Brug.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
173 A 322	— (Cylichna) conuloïdea, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	*B. conulus* of Crag Moll., Vigo Bay, 380 to 994 fathoms, 'Depths of the Sea,' p. 184.
176	— — concinna, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
175	— — cylindracea, *Pennant*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	The Norwich specimen mentioned in Woodward's list is that inserted in the Fluvio-marine Crag column under the name of *C. alba.* Probably only derivative in Red Crag.
178	— (Utriculus) Lajonkaireana, *Bast.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	*B. mamillata ?* Phil.
177	— — Regulbiensis, *Adams*	...	...	...	...	×	×	...	...	...	...	...	...	...	×	×	×	*B. obtusus*, Mont.
176	— — truncata, *Adams*	×	...	...	...	...	×	...	...	...	...	...	...	...	×	×	×	

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
178	Bulla (Utriculus) nana, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	..	
180	Bullæa catena, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*B. sculpta* of Crag Moll.
179	— quadrata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	310 fathoms, off Malta, 'Depths of the Sea,' p. 270.
181	— scabra, *Müller*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*B. dilatata,* Crag Moll.
182 s 96	— ventrosa, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	
173	Scaphander lignarius, *Linn.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*Bulla lignaria* of Crag Moll.
s 96	— librarius? *Lovén*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	...	×	
11	Melampus pyramidalis, *J. Sow.*	...	×	×	...	?	×	...	...	...	...	...	...	...	...	...	...	*Conovulus pyramidalis* of Crag Moll.
12 s 3	— fusiformis, *S. Wood*	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	*C. myosotis* of Crag Moll.
	PTEROPODA.																	
191 s 99	Cleodora infundibulum, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	?	...	?	
	BIVALVIA.																	
8 s 100	Anomia ephippium, *Linn.*	×	...	×	...	×	×	...	×	×	...	...	...	...	×	×	×	
—	— — *var.* aculeata	×	...	...	...	...	×	...	×	...	...	...	...	...	×	×	×	
11 s 100	— striata, *Lovén*	×	...	×	...	...	×	...	×	...	...	...	...	...	×	×	×	
10 s 101	— patelliformis, *Linn.*	×	×	×	...	×	×	...	...	...	...	...	...	...	×	×	×	
13 s 101	Ostrea edulis, *Linn.*	×	×	×	...	×	...	...	...	...	×	×	×	×	×	×	×	
s 101	— cochlear	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	*O. edulis,* var. *spectrum,* of Crag Moll. Derivative in Red Crag.
s 102	— plicatula, *Gmelin*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
17	— princeps, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
s 102	— flabellula, *Lamk.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
19 s 102	Hinnites Cortesyi, *De France*	×	...	×	...	?	...	...	...	...	...	...	...	...	...	...	...	Derivative in Red Crag.
29	Pecten Bruei, *Payr.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	358 to 717 fathoms, in Atlantic, as *P. aratus,* 'Depths of the Sea,' p. 181.
38	— dubius, *Broc.*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
30 s 106	— septemradiatus, *Chemn.*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	*P. Danicus* of Crag Moll.
24 s 104	— (Pleuronectia) Gerardii, *Nyst*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
40 s 103	— Islandicus, *Müller*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	Upper Glacial, Bridlington, *fide* Woodward, Geol. Mag., vol. i, p. 53.
22	— (Janira) maximus, *Linn.*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
23	— — — *var.* grandis, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
35 s 105	— opercularis, *Linn.*	×	×	×	×	×	×	...	×	...	...	...	...	...	×	×	×	
37	— — *var.* gracilis, *J. Sow.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*P. gracilis,* Sow., of Crag Moll.
32 s 103	— princeps, *J. Sow.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 103	— — *var.* pseudo-princeps	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	
33 s 105	— pusio, *Pennant*	×	×	×	...	...	...	...	×	?	...	...	...	...	×	×	×	
25	— (Pleuronectia) similis, *Laskey*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
27	— tigrinus, *Müller*	×	×	×	...	?	×	...	...	...	...	...	...	...	×	×	×	Recently found in Mediterranean, Brit. Con., vol. v, p. 167.
41 s 104	— varius, *Linn.*	?	...	...	...	...	...	...	×	...	...	...	...	×	×	×	×	
s 104	— niveus ? *McGil.*	?	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	
A 323 s 106	— (Janira) Westendorpianus, *Nyst*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably a Cor. Crag species, and only derivative in Red Crag. Fossil Belgian Crag.
43 s 108	Lima exilis, *S. Wood*	×	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
44 s 108	— hians, *Gmelin*	×	...	...	...	...	...	...	?	...	...	...	...	...	×	×	×	
45	— Loscombii, *G. B. Sow.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
48 s 108	— ovata, *S. Wood.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
46 s 109	— plicatula, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	?	...	Possibly young of *squamosa.*

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
47 s 107	Lima subauriculata, *Mont.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
47 s 107	— elongata, *Forbes*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Var. *elongata* of *L. subauriculata* in Crag Moll.
s 109	— squamosa, *Lamk*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
51 s 109 & 188	Avicula phalænoides, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*A. Tarentina* of Crag Moll.
50 s 110	Pinna pectinata, *Mont*	×	?	×	...	...	...	?	...	...	...	...	...	...	×	×	×	
s 110	— rudis, *Linn*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	
52	Mytilus edulis, *Linn*	...	...	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
52	— *var.* hesperianus, *Lam.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	
s 110	— giganteus, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Derivative.
58	Modiola barbata, *Linn*	...	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
60	— costulata, *Risso*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
63 s 111	— discors, *Linn.*	?	...	...	...	...	×	...	...	...	...	...	...	...	×	×	×	
62	— marmorata, *Forbes*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
57	— modiolus, *Linn.*	?	...	×	...	×	...	...	...	×	...	...	...	...	×	...	×	Upper Glacial, Bridlington, *fide* Woodward, Geol. Mag., vol. ii, p. 53 (*M. vulgaris*). Doubtful whether the fragments in Cor. Crag belong to this species.
60 s 111	— Petagnæ, *Scac*	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	
59 s 111	— phaseolina, *Phil*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
64	— rhombea, *Berkley*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
61	— sericea, *Bronn*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
77	Arca lactea, *Linn*	×	×	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
79	— pectunculoïdes, *Scac.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
76 s 116	— tetragona, *Poli*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
66 s 116	Pectunculus glycimeris, *Linn*	×	...	×	×	×	×	...	×	×	...	...	...	...	×	×	×	
66 s 116	— pilosus, *Linn.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Probably derivative in the Red Crag.
66 s 116	— subobliquus, *S. Wood*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
70 s 117	Limopsis aurita, *Broc*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Probably derivative in Red Crag.
71 A 324 s 117	— pygmæa, *Phil*	×	×	×	...	...	...	...	×	...	...	...	...	...	...	×	×	The statement in App., p. 324, that this had been dredged in Arctic seas is erroneous, the species dredged being different.
73	Nucinella miliaris, *Desh.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
82 s 111	Nucula Cobboldiæ, *J. Sow.*	...	...	×	...	×	×	×	×	×	...	...	...	...	...	...	...	
81 s 113	— lævigata, *J. Sow*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 113	— — *var.* calva, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
85 s 114	— nucleus, *Linn*	×	...	×	...	...	...	...	?	...	...	...	...	...	×	×	×	
87	— — *var.* radiata	?	...	×	...	...	...	...	...	...	...	...	...	...	×	×	...	Supplement, Tab. X, fig. 3.
s 113	— nitida, *G. Sow.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
84 s 114	— tenuis, *Mont.*	?	...	×	...	×	×	...	?	×	...	...	...	...	×	×	×	
86 s 113	— proxima, *Say*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	North America only. *N. trigonula* of Crag Moll.
92 s 115	Leda caudata, *Donov.*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	
88 s 115	— lanceolata, *J. Sow.*	...	...	×	...	×	×	...	×	...	...	...	...	...	...	...	×	Arctic seas only.
92 s 115	— minuta, *Mont*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	...	×	
90 s 114	— oblongoides, *S. Wood*	...	...	×	...	×	×	×	×	×	...	...	...	...	...	...	?	*Leda myalis* of Crag Moll.
93	— pernula, *Müll*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	Arctic seas, 358 to 717 fathoms in Atlantic, 'Depths of the Sea,' p. 181.
95	— pygmæa, *Münst*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	Walton, *fide* A. Bell, Ann. and Mag. Hist., Sept., 1870.
s 115	— myalis, *Couth*	...	...	...	...	×	...	×	...	...	...	...	...	...	...	...	×	North America only.
91	— semistriata, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
115 s 121-2	Lepton deltoideum, *S. Wood*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	
116 s 121-2	— depressum, *Nyst*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
116 s 121-2	— nitidum, *Turton*	×	…	…	…	×	×	…	…	…	…	…	…	…	×	×	×	
114 s 121	— squamosum, *Mont.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
s 121-2	Lasæa Clarkiæ, *Clarke*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	…	…	
125 s 121	— rubra, *Mont.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	*Kellia rubra* of Crag Moll.
124 s 121	— pumila, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	?	*Kellia pumila* of Crag Moll.
s 121-3	— intermedia, *S. Wood*	…	…	…	…	…	×	…	×	…	…	…	…	…	…	…	…	
s 121-3	Bornia ovalis, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
126 s 121-5	Montacuta bidentata, *Mont.*	×	×	…	…	…	×	…	×	…	…	…	…	×	×	×	×	
129 s 121-6	— ferruginosa, *Mont.*	×	…	…	…	…	×	…	…	…	…	…	…	…	×	×	×	
127 s 121	— truncata, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	Fossil in Vienna beds.
s 121-6	— elliptica, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
131 s 121-6	Sphenalia donacina, *S. Wood*	×	…	…	…	…	…	×	…	…	…	…	…	…	×	…	…	*Montacuta donacina* of Crag Moll.
128 s 121-7	— substriata, *Mont.*	×	…	…	…	…	×	…	…	…	…	…	…	…	×	×	×	*Montacuta substriata* of Crag Moll.
118 s 121-4	Kellia suborbicularis, *Mont.*	×	×	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
120 s 121-5	Scintilla ambigua, *Nyst*	×	×	×	…	…	×	…	…	…	…	…	…	…	…	…	…	*Kellia ambigua* of Crag Moll.
123 s 121	— compressa, *Phil.*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*Kellia coarctata* of Crag Moll.
122 s 121-4	Scacchia cycladia, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*Kellia cycladia* of Crag Moll.
121 s 121	— elliptica, *Phil.*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	×	×	*Kellia elliptica* of Crag Moll.
s 189	— lata, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
120 s 121-4	— orbicularis, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	…	*Kellia orbicularis* of Crag Moll.
135 s 121-7	Cryptodon rotundatum, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*Cryptodon ferruginosum* of Crag Moll.
134 A 324 s 121	— sinuosum, *Donovan*	×	…	…	…	…	×	…	…	…	…	…	…	…	×	×	×	
137 s 127	Loripes divaricatus, *Linn.*	…	…	×	…	×	…	…	×	…	…	…	…	…	×	×	×	
139 s 128	Lucina borealis, *Linn.*	×	×	×	…	×	×	×	×	…	…	…	…	…	×	×	×	
140	— crenulata, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
141	— decorata, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*L. exigua ?* Hörnes.
146 s 129	Diplodonta Astartea, *Nyst*	×	…	×	…	×	…	…	…	…	…	…	…	…	…	?	?	*L. trigonula ?* Bronn.
145 s 128	— dilatata, *S. Wood*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	Possibly derivative in Red Crag.
144 s 128	— rotundata, *Mont.*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
148 s 130	Lucinopsis Lajonkairii, *Payr*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	Probably derivative in the Red Crag.
s 129	— undata, *Pennant*	…	…	…	…	…	×	…	…	…	…	…	…	…	×	×	×	
150 s 130	Verticordia cardiiformis, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	*Hippagus Verticordius* of Crag Moll.
162 s 130	Chama gryphoides, *Linn*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	×	×	Probably derivative in Red Crag.
168 s 130	Cardita borealis, *Conrad*	…	…	…	…	…	…	…	…	×	…	…	…	…	…	…	×	*C. analis,* Crag Moll. Living in N. E. American seas.
167	— Chamæformis, *Leathes*	×	?	×	…	…	…	…	…	…	…	…	…	…	…	…	…	Probably derivative in Red Crag.
168 s 132	— corbis, *Phil.*	×	×	×	…	…	…	…	×	…	…	…	…	…	…	×	×	
168 s 132	— anceps, *S. Wood*	×	?	?	…	…	…	…	…	…	…	…	…	…	…	…	…	If in Red Crag it is probably so only as a derivative.
167	— orbicularis, *Leathes*	×	…	?	…	…	…	…	…	…	…	…	…	…	…	…	…	If in Red Crag it is probably so only as a derivative.
166 s 131	— scalaris, *Leathes*	×	×	×	…	?	?	…	×	…	…	…	…	…	…	…	?	*C. ventricosa ?* Gould, a Pacific shell.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
165 s 133	Cardita senilis, *Lam.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	×	...	Probably derivative in Red Crag.
157	Cardium angustatum, *J. Sow.*	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	Fluvio-marine Crag (Thorpe by Aldbro'), *fide* A. Bell, Ann. and Mag. Nat. Hist., 1870.
152	— echinatum, *Linn.*	...	...	×	...	...	...	...	...	...	...	...	...	×	×	×	×	
155 s 134	— edule, *Linn.*	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
153 s 133	— fasciatum, *Mont.*	×	...	×	...	...	×	...	...	...	...	...	...	...	×	×	×	*C. nodosum* of Crag Moll.
s 134	— nodosum, *Turt.*	×	...	?	...	...	...	...	...	...	...	...	...	...	×	×	×	
154 s 134	— pinnatulum, *Con.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×	*C. nodosulum* of Crag Moll.
s 137	— Islandicum ? *Linn.*	...	...	...	...	...	...	...	?	?	...	...	...	...	...	...	×	
158 s 135	— Parkinsoni, *J. Sow.*	...	×	×	...	?	...	...	...	...	...	...	...	...	...	...	...	Not *C. Nuttalli.*
154 s 134	— strigilliferum, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
160	— (Aphrodita) Groenlandicum, *Chemn.*	...	...	×	...	×	×	...	...	...	...	...	...	...	...	...	×	
159	— interruptum, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
159 s 135	— decorticatum, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
160	— venustum, *S. Wood*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Var. of *decorticatum* ?
171 s 136	Erycinella ovalis ? *Conrad*	×	×	...	...	...	...	...	×	...	...	...	...	...	...	...	...	
177	Astarte Basterotii, *De la Jonk*	×	?	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
188 s 137	— Burtinii, *De la Jonk.*	×	...	×	...	?	...	...	×	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
175 s 137	— (Triodonta) borealis, *Chemn.*	...	...	...	...	×	×	×	×	×	...	×	...	...	...	...	×	
175 s 137	— — *var.* Withami	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	
183 s 138	— (Nicania) compressa, *Mont.*	...	×	×	...	×	×	×	×	×	×	...	...	...	×	...	×	
186	— crebricostata, *Forbes*	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	×	
184	— crebrilirata, *S. Wood*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Neither *A. depressa* of Brown nor *A. crebricostata* of Forbes.
185 s 138	— Galeottii ? *Nyst*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*A. gracilis* of Crag Moll. Probably derivative in Red Crag.
185	— — *var.* incerta	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
178 s 138	— incrassata, *Broc.*	×	...	×	...	...	...	...	?	...	...	...	...	...	...	×	×	Probably derivative in Red Crag.
179	— mutabilis, *S. Wood*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Fig. 1 *e, f*, Tab. XVI, of Crag Moll., from Bridlington, is probably a variety only of *borealis.* Probably derivative in Red Crag.
189	— obliquata, *J. Sow.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
180 s 139	— Omalii, *De la Jonk*	×	...	×	...	?	...	...	×	...	...	...	...	...	...	...	...	Probably only a derivative in Red Crag.
192 s 140	— Forbesii, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*A. parva* of Crag Moll.
175 s 140	— parvula, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
187	— pygmæa, *Munst.*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
182 s 139	— sulcata, *Da Costa*	...	...	×	...	?	×	...	×	×	...	×	...	...	×	...	×	
181	— elliptica, *Brown*	...	...	...	...	?	...	...	...	×	...	...	...	...	×	...	×	
173	— triangularis, *Mont.*	×	×	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
190 s 141	Woodia digitaria, *Linn.*	×	×	×	...	...	...	...	×	...	...	...	...	...	?	×	×	*Astarte digitaria* of Crag Moll.
191 s 142	— excurrens, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Astarte excurrens* of Crag Moll.
196 s 142	Cyprina Islandica, *Linn.*	×	?	×	×	×	×	×	×	×	×	×	...	...	×	...	×	Fossil in Mediterranean.
197 s 142	— rustica, *J. Sow.*	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	Probably derivative in Red Crag.
193	Isocardia cor, *Linn.*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Probably derivative in Red Crag.
210	Venus casina, *Linn.*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Probably derivative in Red Crag.
212	— imbricata, *J. Sow.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	The var. *gibberosa* is probably derivative in the Red Crag. As to *V. dysera*, see Sup., p. 189.
212	— — *var.* gibberosa	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
211 s 143	— fasciata, *Da Costa*	...	×	×	...	×	...	...	×	...	...	...	...	...	×	×	×	
s 144	— fluctuosa, *Gould*	...	...	...	...	...	...	...	×	×	...	...	...	...	...	...	×	North-east American and Arctic seas only.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
213, s 143	Venus ovata, *Pennant*	×	…	×	…	…	×	…	×	…	…	…	…	…	×	×	×	Probably derivative in the Red Crag, where it is very rare.
A 326, s 144	— gallina, *Linn.*	…	…	…	…	…	…	…	…	…	×	…	…	…	×	×	×	
207	Cytherea Chione, *Linn.*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	In the Red Crag it has only occurred at Waldringfield (Bell, Ann. and Mag., 1870), and is probably derivative.
208, s 142	— rudis, *Poli*	×	×	×	…	?	…	…	×	…	…	…	…	…	…	×	×	
198	Circe minima, *Mont*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	Probably derivative in the Red Crag.
215	Artemis lincta, *Pult*	×	×	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
215	— lentiformis, *J. Sow.*	?	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	The only Cor. Crag specimen is fig. 7 *c*, of Tab. XX, of Crag Moll., and this may possibly be a deformity of *A. lincta.*
202, s 145	Tapes aureus, *Gmel*	…	…	…	…	×	…	…	…	…	…	…	…	…	×	×	×	
A 327, s 145	— decussatus, *Linn.*	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	×	
203	— perovalis, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
A 327, s 145	— pullastra, *W. Wood*	?	?	×	…	…	…	…	?	…	…	…	…	…	×	×	×	Only unique specimens from Coralline Crag and from Walton, which are in bad preservation.
204	— texturatus, *Lam.*	…	×	×	…	…	…	…	…	…	…	…	…	…	×	×	×	Red Crag of Waldringfield, *fide* A. Bell.
201, s 145	— virgineus, *Linn.*	×	×	×	…	×	…	…	?	…	…	…	…	…	×	×	×	
200, s 136	Coralliophaga cyprinoides, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	?	…	
205, s 146	Venerupis Irus, *Linn.*	×	×	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
217, s 146	Gastrana laminosa, *J. Sow.*	×	×	×	…	…	…	…	…	…	…	…	…	…	…	…	?	Closely resembles a South African shell.
220, s 147	Donax politus, *Poli*	×	×	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
219	— trunculus, *Linn.*	…	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
219, s 146	— vittatus, *Da Costa*	…	…	?	…	×	…	…	…	…	…	…	…	…	×	×	×	Given by Mr. Jeffreys from the Red Crag of Sutton, but I cannot learn on what authority.
221	Psammobia Ferroensis, *Chemn.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
s 147	— costulata, *Turt.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
223, s 147	— tellinella, *Linn.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	…	×	
222	— vespertina, *Chemn.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
227	Tellina balaustina, *Linn.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
231, s 151	— Balthica, *Linn.*	…	…	…	…	…	…	×	×	×	×	×	×	×	×	×	×	
230	— Benedenii, *Nyst et Westend*	…	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	Only a derivative in the Red Crag, and may probably turn up in the Coralline.
226, s 151	— crassa, *Gmel.*	×	×	×	…	×	×	…	×	…	…	…	…	…	×	×	×	
234, s 150	— compressa, *Broc.*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	×	×	*Tellina donacilla* of Crag Moll.
233	— donacina, *Linn.*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	Mr. Bell writes me that he has obtained a specimen from the Red Crag of Boyton. This is the only instance known to me from the Red Crag, and is doubtless due to derivation from the Coralline.
232, s 150	— fabula, *Gronov*	…	…	…	…	×	×	…	…	…	…	…	…	…	×	×	×	
228, s 151	— lata, *Gmel.*	…	…	×	…	×	×	×	×	×	…	?	…	×	…	…	×	Arctic only.
228, s 151	— obliqua, *J. Sow.*	×	?	×	×	×	×	×	×	×	…	…	…	…	…	…	…	One specimen found at Walton by Mr. Norton, but this is of doubtful origin.
230, s 151	— prætenuis, *Leathes*	…	?	×	×	×	×	×	…	…	…	…	…	…	…	…	…	One specimen in my cabinet is labelled Walton, but it is of doubtful origin.
s 150	— pulchella? *Lam.*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	×	×	
235, s 153	Scrobicularia plana, *Da Costa*	…	…	×	×	×	×	×	×	…	…	×	×	×	×	×	×	*Trigonella plana* of Crag Moll. *S. piperata*, auctorum.
237, s 152	Abra alba, *W. Wood*	×	×	×	…	?	?	…	…	…	…	…	…	×	×	×	×	
238, s 153	— fabalis, *S. Wood*	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
240	— obovalis, *S. Wood*	…	…	×	…	×	…	…	…	…	…	…	…	…	…	?	…	*Erycina ovata?*
239	— prismatica, *Mont.*	×	…	…	…	…	?	…	…	…	…	…	…	…	×	×	×	Given by Mr. Jeffreys from Aldeby, but I have not been able to learn on what authority.

PAGE.		Cor Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
243, s 155	Mactra arcuata, *J. Sow.*	×	×	×	...	×	×	...	...	...	...	...	...	...	...	...	...	
244, s 155	— artopta, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
249	— (Mesodesma) deaurata, *Turt.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	North American seas only, the British specimens being spurious. See Forb. & H., vol. i, p. 346.
241, s 154	— glauca, *Born.*	...	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	
246, s 153	— ovalis, *J. Sow*	...	...	×	×	×	×	×	×	...	×	×	×	...	×	...	×	The Mediterranean analogue is *M. triangula.*
249	— *var.* constricta, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
244	— procrassa, *S. Wood*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	
245, s 154	— solida, *Linn.*	×	×	×	...	×	×	...	...	...	×	×	...	×	×	×	×	
242, s 154	— stultorum, *Linn.*	×	?	×	×	...	...	...	?	...	...	...	...	...	×	×	×	
247, s 154	— subtruncata, *Da Costa*	...	...	?	×	×	×	...	...	...	...	...	...	...	×	×	×	
248	— — *var.* obtruncata	×	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	
A 325	— triangula, *Renier*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×	*M. triangulata* of Crag Moll.
245	— truncata, *Mont.*	...	×	×	...	...	...	...	...	...	...	...	...	...	×	...	...	
251, s 155	Lutraria elliptica, *Lam*	×	...	×	...	...	...	...	...	...	...	...	...	...	×	×	×	Fragments only in Red Crag, and these probably only derivative. As to *L. oblonga*, see p. 155 of Supplement.
252, s 147	Solecurtus strigillatus, *Linn.*	×	...	?	...	...	...	...	...	...	...	...	...	...	...	×	×	*Macha strigillata* of Crag Moll.
s 148	Cultellus Suttonensis, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
258, s 149	— cultellatus, *S. Wood*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	*C. tenuis* of Crag Moll.
s 148	— pellucidus ? *Penn*	...	...	...	...	...	?	...	...	...	...	...	...	...	×	×	×	Tab. X, fig. 14, of Supplement.
254	Solen gladiolus, *Gray*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	×	
255, s 149	— siliqua, *Linn.*	...	...	×	...	×	?	...	?	...	...	...	...	...	×	×	×	
256	— ensis, *Linn*	×	×	×	...	...	?	...	?	...	...	...	...	...	×	×	×	See Supplement, p. 149, as to occurrence at Aldeby and Hopton.
264	Cochlodesma complanatum, *S. Wood*	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
264	— prætenerum, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
264	— prætenue, *Pult.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
261, s 189	Thracia inflata, *J. Sow*	×	...	?	...	...	...	...	...	...	...	...	...	...	...	...	...	Red Crag, Brightwell, with doubt, in Mr. Jeffreys list. Neither *Conradi nor Corbuloides.* See C. M., p. 261. If in Red Crag, derivative.
s 156	— distorta ? *Mont.*	?	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
259, s 156	— papyracea, *Poli*	×	...	...	...	×	×	...	...	...	...	...	...	...	×	×	×	*T. phaseolina* of Crag Moll.
259	— pubescens, *Pult.*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
262, s 156	— ventricosa, *Phil*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
s 159	Lyonsia — ?	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Species undeterminable.
270, s 157	Pandora inequivalvis, *Linn*	×	×	×	...	...	...	...	×	...	...	...	...	...	×	×	×	
273, s 161	Neœra cuspidata, *Oliver*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
s 161	— obesa, *Lovén*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	Scandinavian seas, 380 to 994 fathoms in Vigo Bay and 2435 fathoms in Atlantic, 'Depths of the Sea,' pp. 184 and 96.
272	— jugosa, *S. Wood*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	?	I have not had the opportunity of comparing this with *N. lamellosa*, Sars. 380 to 994 fathoms in Vigo Bay, 'Depths of the Sea,' p. 184.
268, s 161	Poromya granulata, *Nyst*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	
274, s 160	Corbula striata, *Walker & Boys*	×	×	×	...	×	×	×	×	...	×	×	×	×	×	×	×	
s 159	— contracta ? *Say*	...	...	...	×	...	×	...	×	...	...	...	...	...	...	...	×	North American seas.
275, s 160	Corbulomya complanata, *J. Sow.*	...	×	×	...	...	...	...	...	...	...	...	...	...	...	...	...	*Corbula complanata* of Crag Moll.
287, s 157	Saxicava arctica, *Linn*	×	×	×	...	×	×	×	×	...	...	...	...	...	×	×	×	
285, s 157	— *var.* rugosa, *Linn.*	×	×	×	...	...	...	...	...	×	...	...	...	...	×	×	×	Only the gigantic form in Upper Glacial.
288, s 158	— fragilis, *Nyst*	×	...	...	...	...	...	...	...	...	...	...	...	...	×	×	×	*Panopea plicata.* Algeria, sec. Weinkauff.

PAGE.		Cor. Crag.	Red Crag, Walton.	Red Crag, Sutton and Butley.	Scrobicularia Crag.	Fluvio-marine Crag.	Chillesford beds.	Lower Glacial.	Middle Glacial.	Upper Glacial.	Post Glacial, Kelsey Hill.	Post Glacial, March.	Post Glacial, Hunstanton.	Post Glacial, Nar Brickearth.	Living, Britain.	Living, Mediterranean.	Living, elsewhere.	REMARKS.
289 s 158	Saxicava carinata, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
283 s 162	Panopea Faujasii, *Men de la Groye*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	×	×	*P. glycimeris*, Born. *P. Aldrovandi*, Phil. Derivative in Red Crag.
281 s 161	— ? Norvegica, *Spengler*	…	…	×	…	×	×	…	×	×	…	…	…	…	×	…	×	Northern seas only.
266	Pholadomya hesterna, *J. Sow.*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
276 s 159	Sphenia ovata ?	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	?	*Sphenia Binghami* of Crag Moll. *S. ovata* is a Pacific shell.
s 159	— Binghami, *Turt*	…	×	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
279 s 162	Mya arenaria, *Linn*	…	…	×	×	×	×	×	×	…	…	×	×	×	×	…	×	
277 s 163	— truncata, *Linn.*	×	…	×	×	×	×	×	×	×	×	×	…	…	×	…	×	
291	Glycimeris angusta, *Nyst*	×	…	×	…	…	…	…	…	…	…	…	…	…	…	…	…	Only fragments in Red Crag, and these probably derivative. Not *G. siliqua*.
298 s 166	Pholadidea papyracea, *Solander*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	…	×	The specimen of *Pholadidea* in Crag Moll., Tab. XXXI, fig. 23, is some derivative, and its species being doubtful, it is excluded from the list.
s 163	Pholas candida, *Linn.*	…	…	…	…	×	…	…	…	…	…	…	…	…	×	×	×	
296 s 165	— crispata, *Linn*	…	×	×	…	…	…	×	×	×	×	×	…	…	×	…	×	
s 164	— brevis, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
295 s 165	— cylindrica, *J. Sow.*	…	×	×	…	…	…	…	…	…	…	…	…	…	…	…	…	
s 165	— dactylus ? *Linn.*	…	?	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
s 164	— parva, *Penn*	…	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
292	Gastrochæna dubia, *Penn*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	The tubes only of both these species are found in the Red Crag, and it is probable that they are there only as derivatives.
300	Teredo Norvegica, *Spengler*	×	…	×	…	…	…	…	…	…	…	…	…	…	×	×	×	
	BRACHIOPODA.																	
s 172	Lingula Dumortieri, *Nyst*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	?	
s 171	Discina fallens, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
s 170	Argiope cistellula, *S. Wood*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	?	?	
s 169	Terebratulina caput-serpentis, *Linn.*	×	…	…	…	…	…	…	…	…	…	…	…	…	×	×	×	
s 168	Terebratula grandis, *Blumenb*	×	×	×	…	…	…	…	…	…	…	…	…	…	…	…	…	
s 171	Rhynchonella psittacea, *Chemn*	…	…	×	…	×	×	…	…	×	…	×	…	…	×	…	×	

After rejecting species which are mentioned *in it* as doubtful or undeterminable, and also every repetition of a species in the form of a variety, and rejecting from the Red Crag all species marked in the list as derivative, or as possibly or probably so, and (with the exceptions mentioned in the footnote[1]) treating all ?'s as ×'s, the result of the foregoing list is, as regards the Gasteropoda and Bivalvia, given on the following page:

I have made no analysis of the Scrobicularia Crag, as the fauna obtained from it is too meagre to make it worth while.

[1] The following species occurring in the columns of the list are rejected from the summary, viz. In the Cor. Crag, *Pecten varius, Pecten niveus, Lima plicatula, Modiola modiolus, Artemis lentiformis, Tapes pullastra*, and *Thracia distorta*. *Pyramidella læviuscula* is also treated as not living. In the Walton Red Crag, *Tapes pullastra, Cyprina Islandica, Tellina obliqua*, and *Tellina prætenuis*. In the rest of the Red Crag, *Solecurtus strigillatus*. In the Fluvio-marine Crag, *Scalaria clathratula, Scalaria foliacea Rissoa confinis, Hinnites Cortesyi, Astarte Burtinii*, and *Astarte Omalii*.

FORMATION.	British and not Mediterranean.	British and Mediterranean.	Mediterranean and not British.	Neither British nor Mediterranean.	Not known living.	Total.	REMARKS.
Coralline Crag	20	154	51	24	142	391	Of the 24 species not known either as British or Mediterranean there is but one (and that a doubtful identity), *Cerithiopsis lactea*, which is Arctic. The remainder inhabit seas of lower latitude than Britain. See Note A.
Walton (or Older Red) Crag	13	61	14	10	50	148	Of the 10 species not British or Mediterranean two are Arctic and the rest inhabit seas of lower latitude than Britain. See Note B.
Rest of Red Crag (except Scrobicularia beds)	30	78	14	22	55	199	Of the 22 species not British or Mediterranean thirteen are Arctic, and the rest inhabit seas of lower latitude than Britain. See Note C.
Fluvio-marine Crag	36	38	7	12	18	111	Of the 12 species not British or Mediterranean three inhabit seas of lower latitude than Britain, and the rest are Arctic. See Note D.
Chillesford beds...............	19	44	1	9	14	87	Of the 9 species not British or Mediterranean two inhabit seas of lower latitude than Britain, and the rest are Arctic. See Note E.
Lower Glacial	13	9	...	4	3	29	The 4 species not British or Mediterranean are all Arctic. See Note F.
Middle Glacial	21	43	8	10	12	94	Of the 10 species not British or Mediterranean three inhabit seas of lower latitude than Britain, and the rest are Arctic. See Note G.
Upper Glacial	21	10	...	23	5	59	The 23 species which are neither British nor Mediterranean are all Arctic. See Note H.
Post Glacial	19	26	...	4	...	49	The 4 species which are neither British nor Mediterranean are all Arctic. See Note I.

Note A.—The twenty-four species in the Coralline Crag are the following, viz. *Erato mangeriæ*, which is West Indian; *Nassa granulata*, which is Japanese; *Pyrula reticulata*, a tropical form; *Trophon Costifer*, *Pleurotoma hispidula*, *Cerithium cribrarium*, *Chemnitzia varicula*, *Sigaretus excavatus*, *Bullæa ventrosa*, and *Lasæa pumila*, which are reported by Mr. Jeffreys to have occurred in the abyss of the Atlantic; *Cancellaria mitræformis*, and *Scalaria obtusicostata*, which he reports as West Atlantic; *Trochus multigranus*, *Neæra obesa*, and *N. jugosa*, which he reports from Atlantic and Lusitanian abysses (and the two first of which are also Scandinavian); *Scalaria subulata*, which he reports from the Canaries; *Bulla conuloidea*, which he reports from the Lusitanian Coast; *Cæcum mammillatum* and *Skœnia ovata*, identified by Dr. P. Carpenter with Pacific shells; *Cardita scalaris*, another Pacific shell; *Gastrana laminosa*, a South African shell; *Natica pusilla* and *Nucula proxima*, species inhabiting the coast of the United States; *Cerithiopsis lactea*, which, if identical with the Crag shell, (of which I am doubtful) is the only exclusively Arctic species among the twenty-five.

NOTE B.—The ten species from Walton are the following, viz. *Nassa conglobata,* African; *N. granulata,* Japanese; *Actæon Etheridgii,* which Mr. Jeffreys speaks of as identical with a species (*exilis*) from the Atlantic abyss; *Trophon costifer,* from the same abyss; *Scalara subulata,* which Mr. Jeffreys mentions from Teneriffe; *Gastrana laminosa,* South African; *Cardita scalaris,* Pacific; *Mactra deaurata,* which seems to me to be *M. Jauresii* of the United States Coast; and *Buccinum glaciale* and *Solen gladiolus,* which are Arctic.

NOTE C.—The twenty-two species from the Red Crag other than Walton are the following, viz. *Nassa granulata,* Japanese; *Gastrana laminosa,* South African; *Trochus multigranus,* reported by Mr. Jeffreys from the Atlantic and from the Scandinavian Coast; *Trophon costifer,* from the Atlantic abyss; *Cardita scalaris,* Pacific; *Nassa propinqua* (*trivittata ?* Say), *Pleurotoma bicarinata, Cardium pinnatulum,* and *Mactra deaurata* (*M. Jauresii*), from the coast of the United States; and *Buccinum glaciale, Trophon Sarsii, T. scalariformis, Pleurotoma pyramidalis, P. violacea, Cancellaria viridula, Amaura candida, Natica occlusa, Leda lanceolata, L. oblongoides* (*L. Arctica* ? Gray), *Cardium Grœnlandicum, Tellina lata,* and *Solen gladiolus,* which are Arctic.

NOTE D.—The twelve species from the Fluvio-marine Crag are the following, viz. *Cardita scalaris,* Pacific; *Pleurotoma bicarinata,* United States Coast; *Trophon Costifer,* from the Atlantic abyss; and *Pleurotoma pyramidalis, Cancellaria viridula, Velutina undata, Leda lanceolata, L. oblongoides* (*L. Arctica ?* Gray), *L. myalis, Cardium Grœnlandicum, Astarte borealis,* and *Tellina lata,* which are Arctic.

NOTE E.—The nine species from the Chillesford beds are the following:—*Cardita scalaris,* Pacific; *Corbula contracta,* United States Coast; and *Natica occlusa, Margarita argentata, Leda lanceolata, L. oblongoides* (*L. Arctica ?* Gray), *Cardium Grœnlandicum, Astarte borealis,* and *Tellina lata,* which are Arctic.

NOTE F.—The four Lower Glacial species are—*Leda oblongoides* (*L. Arctica* ? Gray), *L. myalis, Astarte borealis,* and *Tellina lata,* all of them Arctic.

NOTE G.—The ten Middle Glacial species are the following, viz. *Nassa granulata,* Japanese; *Cardita scalaris,* Pacific; *Corbula contracta,* United States Coast; and *Trophon scalariformis, Leda lanceolata, L. oblongoides* (*L. Arctica* ? Gray), *Cardium Islandicum, Astarte borealis, Venus fluctuosa,* and *Tellina lata,* which are Arctic.

NOTE H.—The twenty-three Upper Glacial species are, *Columbella Holbollii, Trophon Sabini, T. ventricosus, T. craticulatus, T. scalariformis, T. Gunneri, Pleurotoma elegantior* (*P. elegans ?* Moll.), *P. pyramidalis, P. scalaris, Trichotropis insignis, Turritella erosa, Natica occlusa, Margarita elegantissima, Pecten Islandicus, Leda caudata, L. pernula, L. oblongoides* (*L. Arctica ?* Gray), *Cardita borealis, Cardium Islandicum, Astarte borealis, A. crebicostata, Venus fluctuosa,* and *Tellina lata,* all of them Arctic.

NOTE I.—The four Post-glacial species are, *Trophon scalariformis, Pleurotoma pyramidalis, Astarte borealis,* and *Tellina lata,* all of them Arctic.

The results of the table indicate an almost identical percentage of forms not known as living in the case of the older Red Crag and the Coralline, which is in conflict with the geological break, which I still believe to exist between the two formations. With the

exception of the Middle Glacial column of it, however, the table shows very forcibly the diminishing Mediterranean aspect of the fauna as we ascend in the geological scale.

In the Coralline Crag there are fifty-two Mediterranean forms not living in the British seas, and only twenty of the converse character; and of these twenty, two, viz. *Odostomia Gulsonæ* and *Psammobia tellinella*, are Lusitanian. In the Walton Red Crag the respective numbers are fourteen and thirteen, but in the rest of the Red Crag the British species not living in the Mediterranean are in number more than double those of the converse character; while in the Fluvio-marine Crag these proportions are increased five-fold, and in the Chillesford beds nineteen-fold. In the Lower Glacial there occur thirteen, in the Upper Glacial twenty-one, and in the Post Glacial nineteen British species unknown in the Mediterranean, but in none of these three deposits does there occur a single species of the converse character.

Simultaneously with these features we find (as shown in notes A to I) a proportional increase of the Arctic species as we ascend through the Crag and Glacial series; and that even in the Post Glacial deposits no less than four out of a total of forty-nine are Arctic shells of the preceding Glacial Period which have since receded from the British Coasts.

The Middle Glacial fauna stands out in some discord with the above, since in it not only do several Mediterranean species unknown to British seas reappear, but the proportion which these bear to the number of British species not known in the Mediterranean is as eight to twenty-one—a much larger proportion than exists in the Fluvio-marine Crag, and altogether beyond the proportions exhibited by the intervening formations. The explanation is probably to be found in the Molluscan remains of this deposit having travelled from some distance, as mentioned in the introduction to this 'Supplement' (p. xxiii). Altogether this Middle Glacial assemblage is a very interesting one, and the most important of any of the formations succeeding the Crag. Several of the species which occur in it seem to have disappeared from the British Coast during the earlier part of the Red Crag; and while some of these are not known living, others are confined to the Mediterranean or other southern waters.

I have only to add that I am equally convinced with the authors of the introduction to this work that the Molluscan remains of the Middle Glacial Sand (fragmentary and worn as they occur in it) are not derived from any older deposit, but are contemporaneous with the sand which contains them.

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OF

SUPPLEMENT TO THE CRAG MOLLUSCA.

PLATE VIII.

Fig.	*Names of the shells.*	PAGE	*Localities from which the specimens figured were obtained.*
1.	*Pecten Westendorpianus* . .	106	Red Crag, Waldringfield, probably derivative.
2, *a*, *b*.	*Unio tumidus*	118	Post-glacial, freshwater, Grays.
3.	— *pictorum*	118	Post-glacial, freshwater, Grays.
4.	*Mytilus edulis ?* var. *giganteus*	110	Red Crag, Sutton. Derivative.
5, *a*, *b*.	*Nucula lævigata*, var. *calva* .	113	Cor. Crag, Sutton, and near Orford.
6.	*Pecten opercularis*, var. *arcuata*	105	Cor. Crag, Sutton.
7.	— *varius ?*	104	Cor. Crag, Sutton.
8.	— *niveus ?*	104	Cor. Crag, Sutton.
9, *a*.	— *Princeps*, var. *pseudo-Princeps* . . .	103	Fluvio-marine Crag, Yarn Hill.
9, *b*.	— — — (right valve)	103	Fluvio-marine Crag, Bramerton.
10.	*Ostrea plicatula*	102	Cor. Crag, Sutton.
11, *a*—*c*.	*Terebratula grandis* . . .	168	Red Crag, Waldringfield.
12.	*Avicula phalænoides* . . .	109	Cor. Crag, near Orford.

(This Plate was engraved in 1870.)

Suppl! Tab. VIII

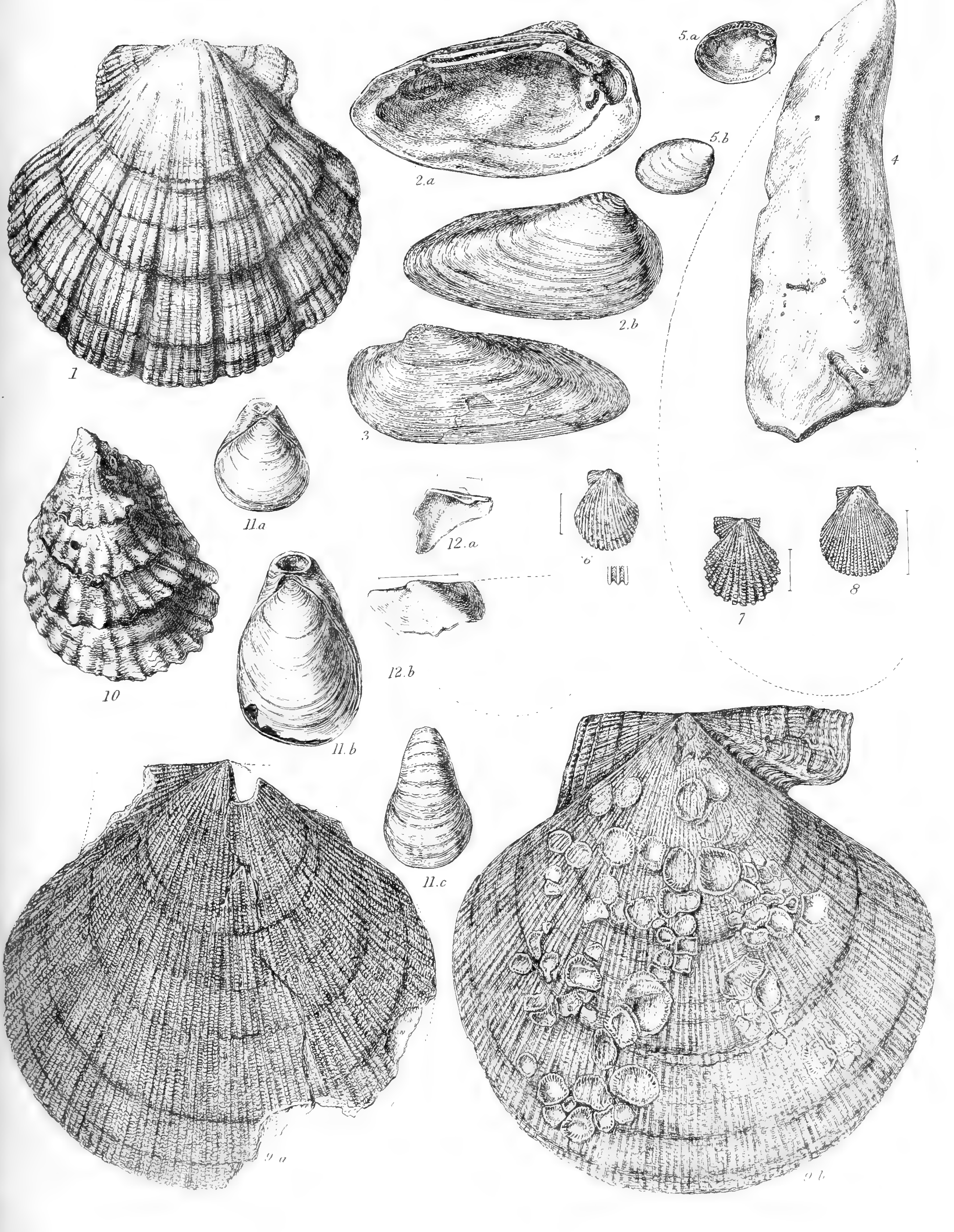


PLATE IX.

Fig.	*Names of the shells.*	PAGE	*Localities from which the specimens figured were obtained.*
1, *a*.	*Tapes pullastra*	145	Red Crag, Walton Naze.
1, *b*.	— —	145	Red Crag, Waldringfield.
2, *a*, *b*.	*Leda myalis*	115	Fluvio-marine Crag, Postwick.
3, *a*, *b*.	*Bornia ovalis*	123	Coralline Crag, Sutton.
4, *a*, *b*.	*Lucinopsis undata*	129	Chillesford beds, Aldeby.
5.	*Lucina borealis* (distorted) .	128	Chillesford beds, Aldeby.
6, *a*, *b*.	*Scintilla ambigua*	125	Cor. Crag, Sutton. (This specimen shows two denticles in left valve.)
7, *a*, *b*.	*Lepton nitidum*	122	Cor. Crag, Sutton.
8, *a*, *b*.	*Venus fluctuosa*	144	Middle Glacial, Hopton.
9, *a*, *b*.	*Scacchia orbicularis* . . .	124	Cor. Crag, Sutton.
10, *a*, *b*.	*Lasæa Clarkiæ*	122	Cor. Crag, Sutton.
11.	*Pinna rudis?*	110	Cor. Crag, Aldbro'.

(This Plate was engraved in 1870.)

Suppl^{t} Tab. IX.

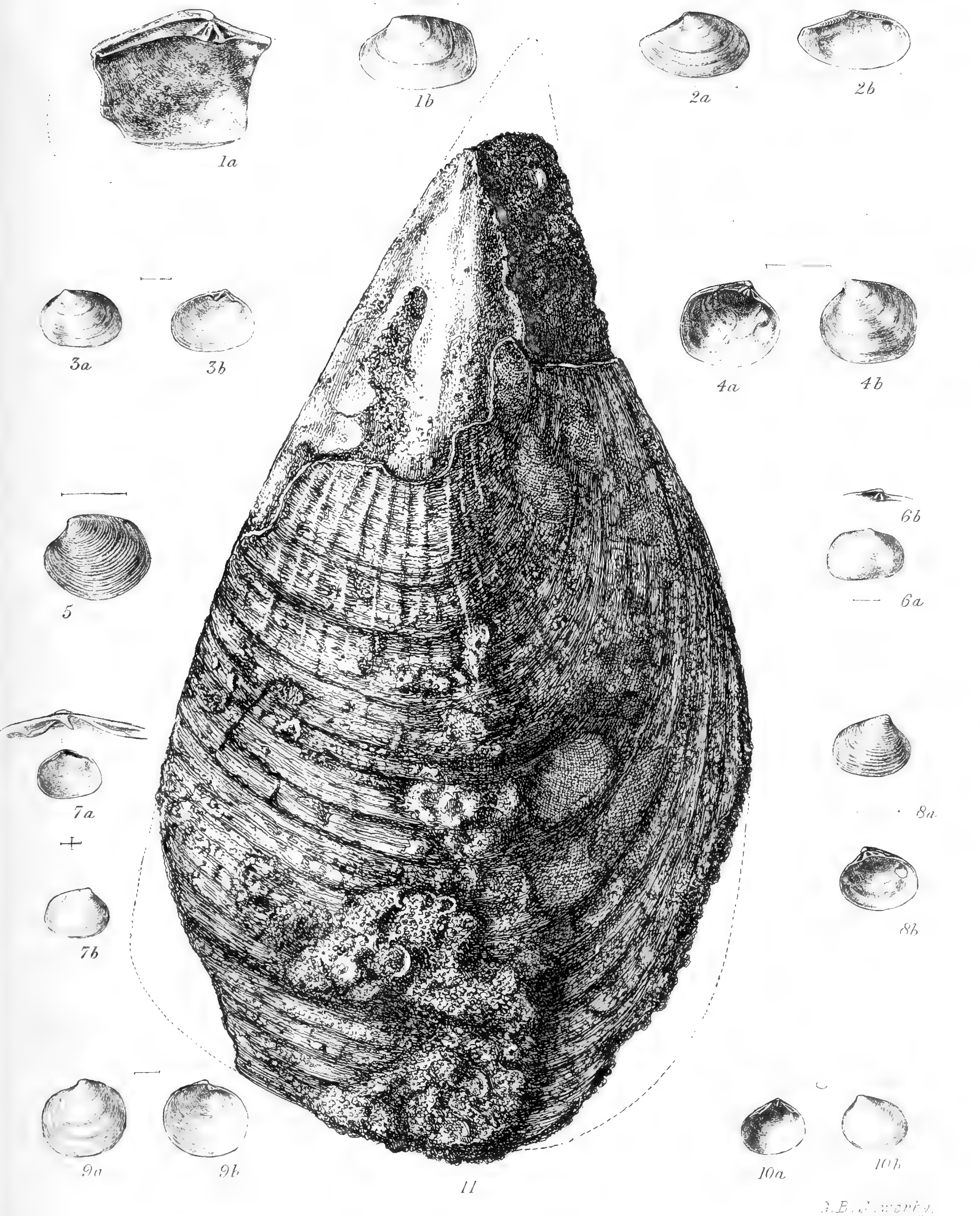
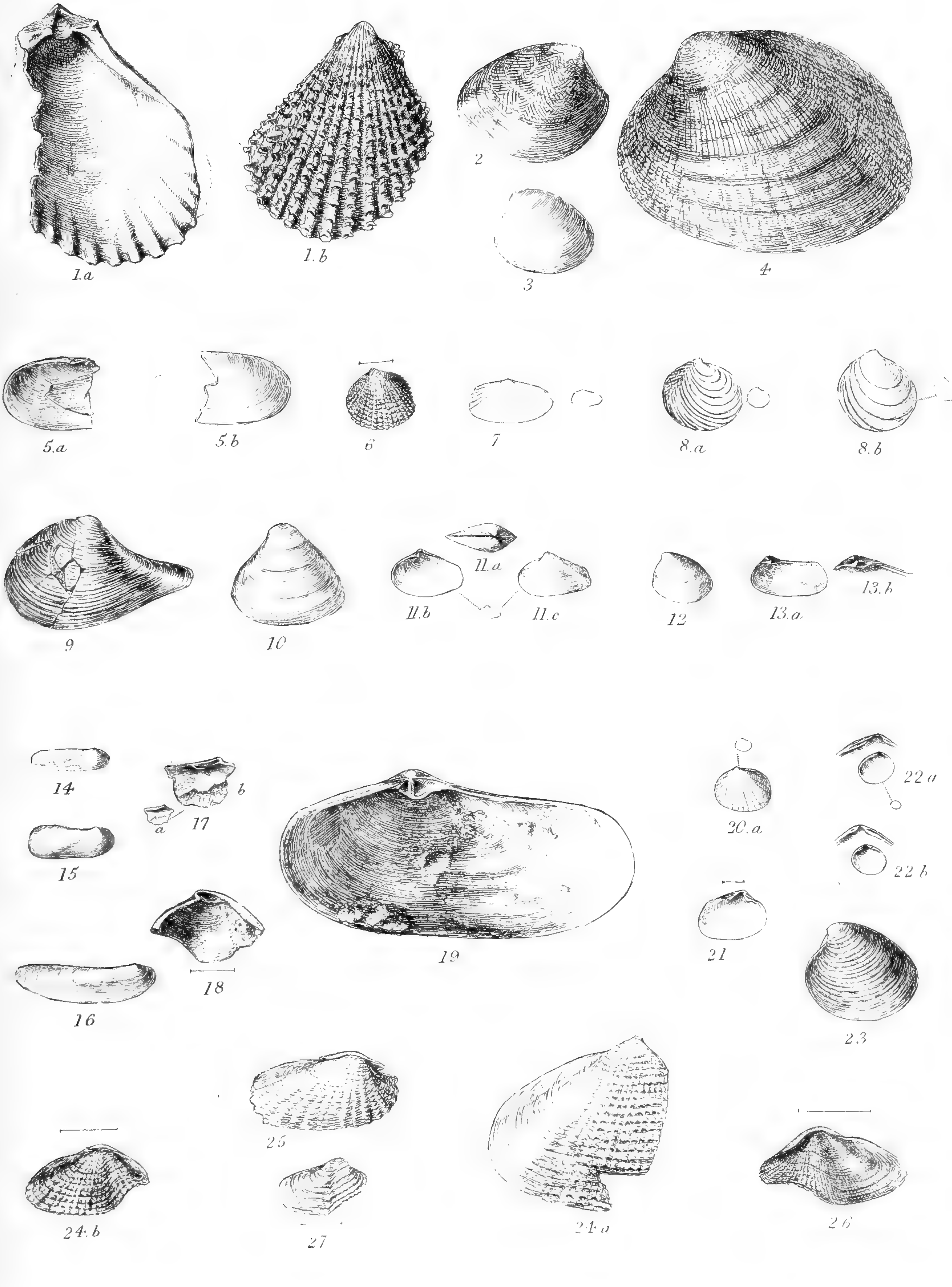


PLATE X.

Fig.	*Names of the shells.*	Page	*Localities from which the specimens figured were obtained.*
1.	*Lima squamosa*	109	*a.* Specimen from Cor. Crag, near Orford, from Mr. Cavell's collection. *b.* From same locality, in Dr. Reed's cabinet.
2.	*Nucula Cobboldiæ*	111	Specimen, with plain margin, from Belaugh.
3.	This was figured under the idea that it was *Nucula radiata* of Forbes and Hanley, but it is probably only a variety of *N. nucleus*		Red Crag, Waldringfield.
4.	*Tapes decussatus*	145	Post-glacial, Nar Valley.
5, *a*, *b*.	*Tellina pulchella ?* . . .	150	Cor. Crag, Sutton.
6.	*Cardium nodosum*	134	Cor. Crag, Sutton.
7.	*Psammobia costulata* . . .	147	Cor. Crag, Sutton.
8.	*Woodia digitaria*	141	8, *a*. Cor. Crag, Sutton. 8, *b*. Hopton.
9.	*Neæra obesa*	161	Cor. Crag, near Orford.
10.	*Mactra solida*	154	Cor. Crag, near Orford.
11, *a*, *b*, *c*.	*Corbula contracta* . . .	159	Norwich Crag.
12.	*Nucula nitida*	113	Cor. Crag, Sutton.
13, *a*, *b*.	*Sphenia Binghami* . . .	159	Red Crag, Waldringfield.
14.	*Cultellus pellucidus ?* . . .	149	Chillesford bed, Aldeby.
15.	— *Suttonensis* . . .	148	Cor. Crag, Sutton.
16.	— *pellucidus* . . .	149	Recent, to show the curved exterior of the living form.
17.	*Lyonsia*	159	A small fragment from Cor. Crag, Sutton, showing area of connexus.
18.	*Loripes lacteus ?*	127	Middle glacial, Hopton.
19.	*Lutraria elliptica ?* . . .	155	Cor. Crag, Ramsholt.
20.	*Sphenalia substriata* . . .	127	Chillesford bed, Aldeby.
21.	*Montacuta elliptica* . . .	126	Cor. Crag, Sutton.
22, *a*, *b*.	*Lasæa intermedia*	123	Chillesford bed, Aldeby.
23.	*Venus gallina*	144	Post-glacial, Kelsey Hill.
24, *a*, *b*.	*Pholas brevis*	164	Cor. Crag, Sutton.
25.	— *candida*	163	Fluvio-marine Crag, Bulchamp ?
26.	— *parva*	164	Red Crag, Waldringfield.
27.	*Pholadidæa papyracea* . .	166	Cor. Crag, Sutton.

(This Plate was engraved in 1872.)

Suppl.t Tab. X.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11.c
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13.a
13.b
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17
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b
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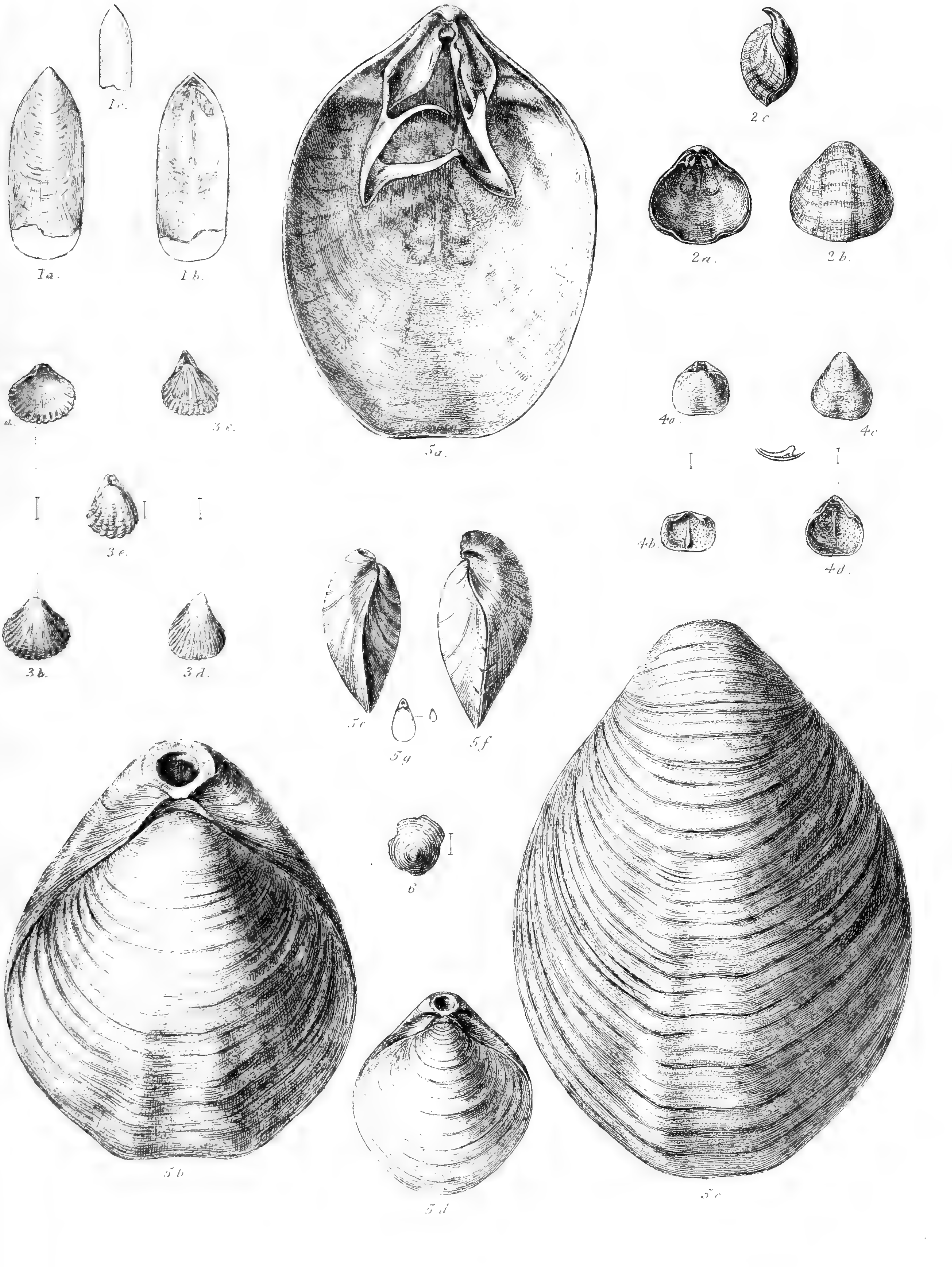
19
20.a
21
22 a
22 b
23
24.b
25
27
24.a
26

TABLE XI.

Fig.	*Names of the shells.*	PAGE	*Localities from which the specimens figured were obtained.*
1, *c*.	*Lingula Dumortieri* . . .	172	Coralline, Sutton.
a, b.	Magnified representations of the same.		
2, *a—c*.	*Rhynchonella psittacea* . .	171	Fluvio-marine Crag, Bramerton.
3, *a—e*.	*Terebratulina caput-serpentis* All magnified figures of young shells.	169	Cor. Crag, Sutton.
4, *a—d*.	*Argiope cistellula*	170	Cor. Crag, Sutton.
5, *a—g*.	*Terebratula grandis* . . .	168	Cor. Crag, near Orford.
a.	Interior of the smaller valve, showing the apophysary system.		Cor. Crag, Ramsholt. The small specimens from Sutton.
6.	*Discina fallens* . . . . The line indicates its magnitude.	172	Cor. Crag, Sutton.

(This Plate was engraved in 1867.)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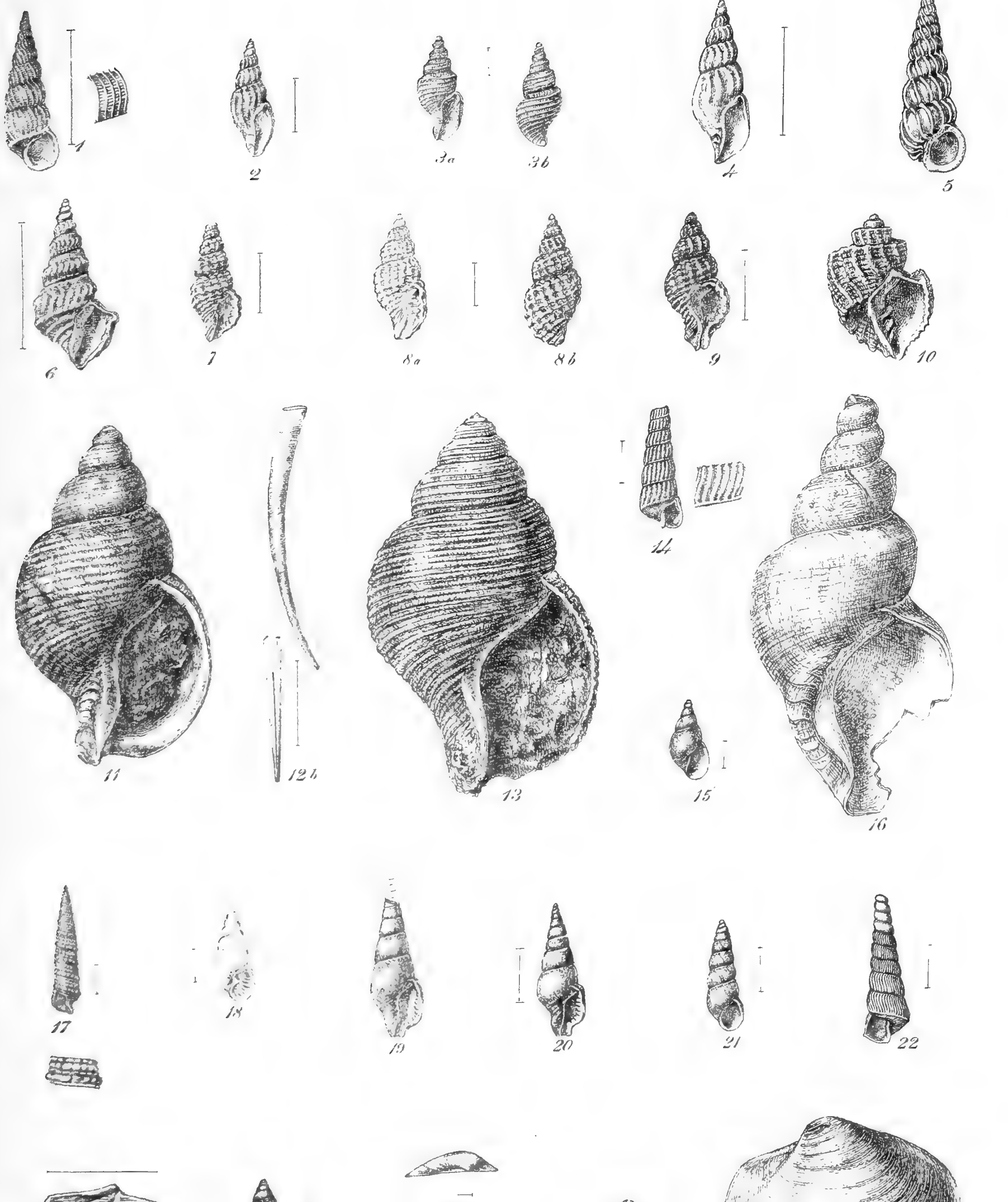
1c.
2a.
2b.
2c.
3a.
3b.
3c.
3d.
3e.
4a.
4b.
4c.
4d.
5a.
5b.
5c.
5d.
5e.
5f.
5g.
6

ADDENDUM PLATE.

Fig.	Names of the shells.	Page	Localities from which the specimens figured were obtained.
1.	*Scalaria semicostata* .	183	Red Crag, probably derivative.
2.	*Pleurotoma striolata* . . .	179	Cor. Crag, near Orford.
3, *a*, *b*.	— *tereoides* . . .	178	Cor. Crag, Sutton.
4.	— *Bertrandi* . .	179	Red Crag, Butley.
5.	*Scalaria communis*	183	Recent.
6.	*Aporrhais Serresianus?* . .	180	Cor. Crag, near Orford.
7.	*Lachesis Anglica*	175	Cor. Crag, near Orford.
8, *a*. *b*.	*Pleurotoma clathrata?* . .	178	Cor. Crag, Sutton.
9.	*Murex insculptus*	176	Red Crag, Waldringfield, probably derivative.
10.	*Cancellaria umbilicaris?* . .	182	Red Crag, Waldringfield, probably derivative.
11.	*Buccinum Tomlinei* . . .	175	Red Crag, Waldringfield, probably derivative.
12.	*Dentalium entalis*	187	Cor. Crag, near Orford.
13.	*Trophon elegans*	177	Cor. Crag, Sutton.
14.	*Chemnitzia Jeffreysii?* . .	184	Cor. Crag, Sutton.
15.	*Odostomia albella*	184	Cor. Crag, Sutton.
16.	*Trophon Norvegicus* . . .	177	Red Crag, Sutton.
17.	*Cerithium perversum?* . .	181	Cor. Crag, Sutton.
18.	*Odostomia dentiplicata* . .	185	Cor. Crag, Sutton.
19.	*Columbella Borsoni?* . . .	174	Red Crag, Walton Naze.
20.	— *minor* . . .	174	Cor. Crag, near Orford.
21.	*Menestho Britannica* . . .	185	Cor. Crag, Sutton.
22.	*Clausilia Pliocena*	188	Cor. Crag, Sutton.
23.	*Avicula phalænoides* . . .	188	Cor. Crag, near Orford.
24.	*Nassa pusillina*, var. *variabilis*	176	Red Crag, Butley.
25.	*Scacchia lata*	189	Cor. Crag, Sutton.
26.	*Bulla utriculus?*	187	Cor. Crag, near Orford.
27.	*Thracia dissimilis*	189	Cor. Crag, near Orford.

(This Plate was engraved in 1873.)

Addendum Plate.



G.B. Sowerby

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MONOGRAPH

ON

THE FOSSIL REPTILIA

OF THE

WEALDEN AND PURBECK FORMATIONS.

SUPPLEMENT No. V.

PAGES 1—18; PLATES I & II.

DINOSAURIA (IGUANODON).

[WEALDEN AND PURBECK.]

BY

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FOREIGN ASSOCIATE OF THE INSTITUTE OF FRANCE,

ETC. ETC.

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SUPPLEMENT (No. V)

TO THE

MONOGRAPH

ON

THE FOSSIL REPTILIA

OF

THE WEALDEN AND PURBECK FORMATIONS.

(IGUANODON.)

§ 1. Mandible and Mandibular Teeth. Plate I, figs. 1, 8.

The dentary element of the right mandibular ramus of the young Iguanodon ('Monograph on Wealden Reptilia, *Dinosauria*, Iguanodon,' part, ii, Plates XI, XII),[1] discovered in the Wealden of Stammerham, near Horsham, Sussex, by G. B. Holmes, Esq., demonstrated the fact that the sculptured surface of the crown in the teeth of the lower jaw was turned inward, the smooth surface outward, toward which aspect the entire tooth was moderately bent. Moreover, the alveoli in that jaw showed eighteen teeth to be the number supported in a close-set series and working position in the dentary element (ib., ib., p. 22).

The portion of mandible obtained by S. H. Beckles, Esq., from the locality of the limb-bones described in 'Supplement' No. IV,[2] is also the dentary element of the right ramus, of which a figure of the inner side is given in Plate I. On this surface the crowns of seven teeth nearly risen into place are seen; the worn crown and fang of a few of the preceding generation of teeth (*a*, *a*) have been preserved, and the summits of the crown of a few teeth of a third set (*c*) in succession are seen in the interspaces of the more developed teeth of the second set (*b*, *b*).

The length of the portion of mandible here preserved is eighteen inches; that of the corresponding part of the mandible of the Iguanodon discovered by Captain Brickenden in the Wealden of Tilgate (ib., ib., Pl. XIII) measured 20 inches. It is probable, therefore, that Mr. Beckles' specimen had nearly attained the full average size of the great herbivorous reptile.

The antero-posterior breadth of the teeth rising into place averages 9 lines; the largest mandibular teeth of Iguanodon (ib., ib., Pl. XVIII, figs. 3, 3 *a*) give 1 inch

[1] Pal. Soc. Vol. for year 1854. [2] Ibid. 1871.

3 lines in the same dimensions. The crown-germs of the teeth in the Stammerham jaw (ib., ib., Pl. XI) average 6 lines; we thus learn that each successive series of teeth had an increase of size corresponding in a general degree with the growth of the jaw.

The subject of fig. 1, Pl. I, of the present Monograph shows at its interior or symphysial end the abrupt slope downward of the short, edentulous, compressed part, which curves inward to meet the corresponding part of the opposite ramus at a short symphysis, extending along an horizontal surface, parallel with the straight lower border of the mandible. The smooth canal thus formed above the symphysis indicates a relation of facility in regard to the movements of protrusion and retraction of a long, cylindrical, muscular tongue, probably used, like that of the Giraffe and Megatherium, for the prehension of the vegetable substances selected by the Iguanodon for food. It is a generic mandibular character.

The commencement of the coronoid process, contributed by the dentary, is the same in extent as that shown in the younger Iguanodon's jaw (ib., ib., Pl. XI, *a*, *f*), and indicates the position of the suture of the dentary with the surangular element.

The surface of the tooth-crowns here exposed shows the submedian primary vertical ridge, which, in detached teeth, indicates the hinder border of the crown by its proximity thereto. The secondary ridge is less strongly marked, and is best shown in the hindmost teeth. The anterior lamello-serrate border describes the usual convex curve; the posterior border being almost straight along its chief extent. The dental characteristics of *Iguanodon Mantelli*, as illustrated in previous plates (ib., ib., Pl. XVIII, Supplement, No. III, 'Iguanodon,' Pl. X),[1] are well maintained. The secondary ridge is, however, less developed than in the larger teeth of older Iguanodons. The alveolar border here, as in the smaller jaw (Pl. XII, fig. 3), describes a gentle sigmoid curve in the transverse direction, the convexity being inward in the hinder two thirds, then straight or slightly concave to the commencement of the symphysial slope. Three generations of teeth, *a*, *b*, *c*, are exposed in the present mandibular fossil (Pl. I).

In the inwardly convex part of the alveolar tract the teeth are placed 'en echellon;' the fore-and-aft plane of the anterior tooth (Pl. I, fig. 1 *b*), if carried back, would pass outside the succeeding tooth, and the crown of this stands in like relation to the next tooth behind. Thus, when fully in place, the crowns slightly overlap in the lower as in the upper jaw ('Monograph on Iguanodon,' Part No. I, Plate XI, fig. 2),[2] and eighteen teeth may range along an alveolar tract, which, if each tooth stood clear of the next, would not support more than fourteen. Room is also got for the full number along the working line by a certain alternation in the degree of attrition, as is well exemplified in the portion of mandible of a younger or smaller Iguanodon next to be described (Pl. I, fig. 8).

Three views of an upper tooth (Pl. I, figs. 2, 3, 4) and three views of a lower tooth

[1] Pal. Soc. Vol. for year 1862. [2] Ibid. 1854.

(ib., figs. 5, 6, 7) are taken from teeth of the same individual as that to which belonged the mandible (fig. 1) and the bones of the fore-foot described in 'Supplement,' No. IV.

I am indebted to A. J. Hogg, Esq., for the opportunity of examining and figuring the instructive specimen (Pl. I, fig. 8). It was discovered in the hard limestone, locally known as the "Under Feather," which is situated from four to five feet below the accumulation of shells of *Ostrea distorta*, called the "Cinder Bed," in the Middle Purbecks.

A reference to p. 22, fig. 4, of my 'Monograph on the Fossil Mammalia of the Purbeck Formations, British Mesozoic Mammals' (Palæontographical Society, vol. xxiv, issued for 1870), will show the position of the Middle Purbeck series in which the present interesting evidence of the Iguanodon was entombed. It is the first example of that genus, to my knowledge, from the Purbeck series.

In making this statement I refer, of course, to the unequivocal evidence of Iguanodon afforded by the dentition. A large phalangeal bone is figured by Buckland in Pl. XLI, 'Geological Transactions,' Second Series, as a "metacarpal" of Iguanodon. It was picked up "on the sea-shore, about half a mile north of the village of Swanwich" (ib., p. 428), and though "more or less injured by rolling on the sea-shore" has most claim to be referred to the hind-foot of the Iguanodon. It was most probably washed out of the cliffs of iron-sand and sandy clay described by Webster as dividing the Greensand of Ballard Down from the upper body of the Purbeck "limestone."

The portion of jaw here exposed (Pl. I, fig. 8), is the dentary element of a right mandibular ramus, about the size of the Stammerham specimen (Monogr. cit., vol. for 1854, Plates XI, XII), but is mutilated at both ends; it includes, however, in an alveolar tract of four inches, ten teeth, alternately young and old. The foremost, *b*, is a lanceolate and acuminate crown-germ, least advanced in size and lowest in position in the jaw. The second, *a*, is fully in place with the upper third of the crown worn away and supported by a long, slender, tapering fang, occupying the interspace between the first and third teeth. The latter shows the crown fully formed, with the apex risen almost to the level of the worn surface of the antecedent tooth, between which and the fourth it accurately fills the interspace. The fourth tooth, *a*, rises to a higher level than the second and has rather more of the crown worn away; much of its narrow fang is exposed. The crown of the fifth tooth—third of its series, *b*—fills, like the third tooth—second of the series *b*—the interval between the fangs of the fourth and sixth teeth. The sixth tooth rises a little higher than the fourth, and is rather more worn. The seventh tooth—fourth of the series *b*—is more complete and rises higher than the fifth or third; the apex of its crown is on a level with the worn surface of the sixth tooth: the outer part of the lower half of the crown and beginning of the fang of the seventh tooth has been broken away, showing the pulp-cavity in the latter. The eighth tooth—fourth of the series, *a*—is worn down to the contracted base and beginning of the fang. The ninth tooth has risen above it, has come into service, and the crown is supported by a strong root. Beyond this is part of the crown of a successional tooth of a third series, *c*.

The close interlocked fitting of these teeth of different stages and periods of growth is most instructively shown in the present specimen; former ones had given only a partial view of this arrangement, suggestive, however, of an Iguanodontal character of dentition, which is here demonstrated.

The primary and secondary ridges are more equally developed, and the tertiary ridges less conspicuous, in these lower teeth of a Purbeck *Iguanodon* than is usual in the larger or older Wealden specimens. If any Palæontologist should see in this a specific character he may, perhaps, accept the name of *Iguanodon Hoggii.*

§ 2. Skull and Teeth of *Iguanodon Foxii*. Plate I, figs. 9, 9 *a*, 10; Plate II, figs. 1, 5, 8—18.

This section of the present Monograph may be regarded as a Supplement to the paper by Professor Huxley, F.R.S., F.G.S., in the 26th volume of the 'Quarterly Journal of the Geological Society,' p. 3, Pl. I, figs. 1—4 (1870), in which its chief subject has been described and figured with characteristic care. The conclusions of the author as to the generic relationship of the species to which this unique fossil skull belonged, were not, however, satisfactory to its discoverer, and he, consequently, placed the specimen in my hands.

The desirability of throwing light upon the cranial characters of Iguanodon, supposing it should be admitted that there may be here a source of such, will serve, I trust, as an excuse with palæontologists generally, for my presuming to go over ground already trodden by so able a predecessor, and the result may be that the Rev. W. Fox will not stand alone in rejecting the ascription of his fossil to a genus "*Hypsilophodon*."

The articular or condylar part of the basi-occipital (Pl. II, fig. 1, 1) is broken away, a portion of the broad basilar part of the bone (ib., fig. 5, 1) remains in articulation with the basi-sphenoid (ib., ib., 5). This element shows a median contraction with lateral emarginations, bounded anteriorly by the pair of pterapophyses (*t*, *t*). The left of these abuts in its natural position against the corresponding pterygoid, the hinder branch of which, diverging obliquely backward, is broad and moderately concave on its postero-internal surface; the end which would have abutted upon the inner and back part of the tympanic is broken off. There is no apparent "pre-sphenoid style" from the interspace of the pterapophyses.

The left half of the foramen magnum (Pl. II, fig. 1 *f*) is entire, showing a vertical diameter of 4 lines, a transverse one of 5 lines; the lower part shows the fractured surface from which the left exoccipital portion of the occipital condyle has been broken away: the basi-occipital part of the condyle is wanting. The super-occipital (ib., ib., 3) rises broadly and vertically from the upper half of the foramen, *f*, for an

extent of 6 lines; a tract of matrix of 3 lines extent intervenes between the super-occipital, which here shows a jagged upper margin, and the hind border of the parietal, 7. It may be, as in *Varanus* (ib., fig. 2), that an unossified tract of the cranial walls has been left here; or an angular ridge, as in the Crocodile (ib., fig. 4, 3), may have been broken away. The direction of the occipital surface is more vertical than in Lizards. The mid-tract of the super-occipital is moderately convex transversely, the lateral tracts as moderately concave to the lateral borders of the occiput, which borders gently converge as they rise (Pl. II, fig. 1, 3). The exoccipitals (2) extend, connately with the par-occipitals (4), outward, slightly downward and backward, for an extent of 9 lines from the foramen magnum, preserving a vertical breadth of 4 lines.

In *Iguana* (Pl. II, fig. 3) the super-occipital (3) is a vertical crest, from which the sides slope forward and outward at an acute angle. In *Varanus* (ib., fig. 2) the super-occipital surface (3) is transversely convex and strongly inclined from the foramen magnum (*f*) upward and forward. The small Dinosaur, like *Dicynodon,* shows a crocodilian type of the occiput.

The left tympanic (ib., fig. 1, 28) has been dislocated inward, and lies with its upper end beneath the par-occipital abutment (4).

The pterygo-palatine structures accord with the lacertian type. The proportions of the pterapophyses (ib., fig. 5, *t*) are more like those of *Varanus* (ib., fig. 6, *t*) than of *Iguana* (ib., fig. 7, *t*); but the pterygoid of the small Dinosaur resembles that bone in the herbivorous Lizard. The right pterygoid (fig. 5, 24) retains part of the tympanic process (*a*) and of that (*c*) which abutted against the ectopterygoid (25); a portion of the right palatine (20) is preserved, of small size, showing an anterior and posterior emargination, as in *Varanus* (ib., fig. 6, 20). The hind end of the right maxillary with the abutting part of the ectopterygoid are broken away in the fossil. The right malar bone has left its impression on the matrix (Pl. I, fig. 9, 26).

The masto-postfrontal zygoma (ib., 8—12), in its breadth and relative position to the occiput and parietal, is crocodilian. The normal or lower (malo-squamosal) zygoma is indicated on the right side by the impression of the malar and a remnant of the squamosal; a larger proportion of which is preserved on the left side (Pl. II, fig. 1, 27) abutting against the tympanic (ib., 28). It is also shown in Pl. I, fig. 9 *a*, where the parts are drawn without reversing. The upper outlet of the temporal fossa is smaller than in Lacertians, larger than in existing Crocodiles; its proportions are those of some Teleosaurs and Dicynodonts, and are approached by those of the small Crocodilian from the same Wealden locality (ib., fig. 24, *t, t*).

The skull of *Scelidosaurus,* which gave the first considerable insight into the type of that part of the Dinosaurian skeleton, had, unfortunately, lost so much of the fore-end as prevented the application of the external narial test of its correspondence with one or other of the two existing divisions of Brongniart's *Sauria.* It could not, thereby, be determined, for example, whether the outer part or process of the fore-end of the nasal

applied itself to the anterior edge of the ascending process of the maxillary, or to that of the premaxillary; in other words, whether the maxillary entered into the formation of the outer nostril, as in *Lacertilia*, or was excluded therefrom, as in *Crocodilia.*

The present Dinosaurian skull supplies this test and shows its correspondence with the Crocodiles; there is, nevertheless, a touch of the Lizard. For the body or jaw-part of the premaxillary (Pl. I, fig. 9, 22) sends upward not only the process from its hinder part (22^x), applying itself to the outer border of the fore-part of the nasal (15) and excluding therefrom the maxillary (21), but it also sends upward a more slender process from the fore-part, which terminates in a point wedged between the ends of the nasals and dividing the right nostril (*n*) from the left, after the lacertian type. Yet, again, the Crocodilian affinity is here manifested, for the premaxillaries are not confluent and the dividing process is not a single and symmetrical one, as in *Iguana*, *Varanus*, and most Lizards,[1] but is bisected by the medial suture or cleft dividing the right from the left premaxillary. The premaxillary thus, in the main, adheres to the type of that of the Crocodile, circumscribing all that part of the nostril which is not due to the nasal bone itself, and excluding the maxillary from the boundary of the respiratory opening. The application of the outer process of the fore-end of the nasal to the anterior edge of the ascending process of the maxillary[2] could only be predicated by one mistaking a crack of the premaxillary for the suture. The ascending process (Pl. I, fig. 9, 22^x) with which the nasal articulates at the outer part of its fore-end belongs to the premaxillary as well as does the inner process of the same end of the nasal bone.

The premaxillo-maxillary suture extends from behind the sixth obvious premaxillary tooth for the extent of nearly an inch, with a slight curve convex forward, between the two main elements of the upper jaw. The maxillary and premaxillary have been slightly separated from each other along this suture by the force which has fractured both bones; but the margins of the suture show its true nature and distinguish it from the fractures, especially those on the body of the premaxillary, one or other of which must be adopted for a suture on the hypothesis of the hinder ascending process (22^x) belonging to the maxillary bone.

Of the six premaxillary teeth in place the foremost alone (Pl. I, fig. 9, *i*) has the crown entire; its outer surface is convex across and lengthwise, most so along the middle, transversely, the main or mid-ridge of the Iguanodontal teeth being thus indicated. The margins are also slightly relieved (Pl. II, fig. 18, magn.) and converge at an acute angle to a sharp, slightly incurved, apex; the enamel is minutely punctate. Neither in the right nor the left deflected part of the premaxillary, anterior to the pointed tooth, is there any trace of socket or fang. It would seem that this end of the premaxillaries was edentulous, like the corresponding slope of the symphysial part of the mandibular rami to which it was

[1] *Hatteria* (*Rhynchocephalus*) is an exception ('Phil. Trans.,' 1862, plate xxv, fig. 5, 22, p. 467).

[2] "The outer, in like manner, applies itself to the anterior edge of the ascending process of the maxillary and forms a part of the outer boundary of the nostril."—Huxley, ut supra, p. 4.

applied. The outer surface of the deflected ends of the premaxillaries is pitted and finely punctate or rugose.

The fractured bases of the premaxillary teeth succeeeding the first show a transverse diameter nearly eqnal to the fore-and-aft one, and I can form no judgment as to the shape of their missing crowns, save on the analogy of the Iguanodon. They are close-set, and if those crowns extended antero-posteriorly they must have overlapped. This Iguanodontal arrangement is demonstrated in the undisturbed maxillary teeth, of which eight are recognisable; the hind border of one crown overlaps the fore border of the tooth behind.

The two anterior maxillary teeth have slipped in part from their sockets and do not show this arrangement. The first is the smallest antero-posteriorly, but its crown has been worn to the fang, and when entire would be larger in that direction. The second tooth is less worn, and yields in size to the third. In the fifth the full size of the crown, antero-posteriorly, is shown, and this tooth is selected for the magnified view in Pl. I, fig. 10.

The outer surface of the crown is bisected by a medial primary longitudinal ridge; behind this ridge the surface is smooth and concave transversely; in front of the ridge the similarly concave surface is accentuated by two low secondary longitudinal ridges. The same characters appear, in the degree in which the crown is unworn, in the other maxillary teeth.

In upper or maxillary molars of *Iguanodon Mantelli* the following varieties have been recognised and figured.

In the 'Monograph on the Iguanodon' (Palæontographical Society's volume for 1854, issued 1855, Pl. XVIII, fig. 2) the primary ridge is nearer the fore border of the crown than in fig. 10, Pl. I, of the present Monograph; there is a feeble indication of a secondary ridge on the anterior transversely concave facet. There are two secondary ridges in the posterior facet, as in fig. 10, and the crown is so worn down as to show no trace of marginal serrations.

In the upper tooth, fig. 1, Pl. XVIII (Monograph cit.), the crown is less worn and the marginal serrations appear beyond the line of extreme breadth. The anterior facet shows no secondary ridge; the two such ridges in the posterior facet run together in the terminal part of the crown.

In the 'Monograph on Iguanodon, Supplement No. II' (Pal. Vol. for 1858), "Cretaceous Reptilia," Pl. VII, fig. 2, three upper molars are shown *in sitû* with the Iguanodontal overlap, viz. the hind border of a fore-tooth (*m*) over the fore-border of the next tooth (*n*): in these upper molars the primary ridge is sub-medial, and the front face smooth as in fig. 10, Pl. I, of the present Monograph; the two secondary ridges on the hind facet are feebly indicated. The marginal serrations are shown in the preserved terminal part of the crown, which is entire in the teeth marked *n* and *o*. Bisect the tooth *n* at the line at which it is worn away in figs. 9 and 10, Pl. I, and no

serrations would appear. In some upper molars of Iguanodon the margino-serrate character is continued in a minute form nearer to the base of the posterior margin. I have figured a left upper molar of this variety in figs. 2, 3, 4, of Pl. I, and also to show the further variety of three secondary ridges on the hind facet of the crown.

But the upper molars in the subject of fig. 9 show, as in the enlarged view (fig. 10), a continuation of the relieved or raised lateral borders across the base of the crown, in a curved course, convex toward the fang. This basal ridge does not project beyond the origin of the primary ridge, but falls into that origin.

I have not observed this character, at least so definitely marked, in any upper tooth of *Iguanodon Mantelli*, and I regard it as indicative of a specific distinction of the smaller Iguanodon now under review, believing myself entitled to conclude as to its generic relationship from the characters of the dentition of the upper jaw above defined and illustrated.

It is true that one, at least, of the premaxillary teeth is canine-like with a crown "lanceolate and acuminate." But no portion of the skull of *Iguanodon Mantelli* has yet been discovered which would supply the means of testing its resemblance to or difference from the smaller species, in regard to this dental character. Consequently, prior to our knowledge of the skull and dentition of the smaller species, the discovery of a tooth answering in size to the ordinary upper molars of *Iguanodon Mantelli*, but with a "lanceolate and acuminate crown," would naturally suggest its reference to some other Dinosaurian genus of the Wealden, of the bulk of the Iguanodon. In giving a description of this tooth in the 'Supplement on Wealden Reptilia,' in the Palæontographical volume for 1857, issued in 1859 (p. 42), I therefore suggested that it might belong either to *Cetiosaurus* or *Pelorosaurus*. I now, however, from its resemblance to the entire premaxillary tooth in the small Iguanodon—as close as is the resemblance in the maxillary teeth—deem it more probably to belong to the larger species and to be a premaxillary tooth of *Iguanodon Mantelli*. As such, two views of this tooth of half the natural size are given in Pl. II, figs. 19 and 20, for comparison with the magnified view of the laniary of the smaller species (fig. 18). The surface of the crown (fig. 20) which answers to the outer one in fig. 18, and in *i*, fig. 9, Pl. I, is convex both lengthwise and transversely, and most so in the latter direction along the middle part; the main or mid-ridge of the maxillary Iguanodontal teeth being thus represented. On the opposite (inner) side of the crown (fig. 19, Pl. II) the surface is concave across the two thirds next the apex. One margin, the anterior according to the analogy of the small Iguanodon, is convex, the hinder margin along its terminal half is slightly concave. The crown expands antero-posteriorly above the root to nearly midway to the apex, towards which the borders then converge to a point with the different contours above noted. Both borders are trenchant, not serrate.

Now that we know that a laniariform, or 'lanceolate and acuminate,' premaxillary tooth was associated with molars of the Iguanodontal type, in a small exemplar of the genus,

we may anticipate that the premaxillary part of the skull of *Iguanodon Mantelli*, when discovered, will show teeth, if they should be preserved there, of the laniary type exemplified in Pl. II, figs. 18, 19, and 20. The anterior mutilation of the skull of the *Scelidosaurus*, with maxillary teeth having the terminal and more expanded half of the crown serrate (Pl. II, fig. 21), precludes, at present, the determination whether the iguanodontoid molars of this genus were similarly associated with anterior laniaries. But the dentition of the small Purbeck Dinosaur (*Echinodon*), with a corresponding type of maxillary dentition (Pl. II, fig. 22), does include one or more laniaries in advance of molars of the serrate type, as in the small and large Iguanodons ('Monograph on the Fossil Reptilia of the Cretaceous and Purbeck Strata,' Pal. Soc. vol. for year 1858, p. 35, Pl. VIII, figs. 1, 1 *a*).

I next proceed to determine how far the dentition in the small skull repeats the iguanodontal character of overlapping arrangement of the crowns of the teeth.

The right tympanic and mandibular ramus are wanting in the fossil. The left mandibular ramus has been pushed obliquely to the right side, and its fore end has partly displaced the first and second molars, beyond which the projecting end has been broken away. The crowns of those teeth, so driven out of line, are thereby partly withdrawn from their sockets, so as to expose the basal half of their fangs. From this I infer that the force has operated upon the recent animal: for, if it had acted subsequent to fossilisation, through movement of the matrix, it would have broken the teeth, at that time cemented to their sockets. Howsoever that may be, displacement is obvious, and no inference can be drawn as to the original relative position of the crowns of these anterior teeth. As it is, the anterior edge of the crown of the third molar does not overlap in the slightest degree the posterior edge of the crown of the tooth before it; the reverse is the case if any overlap at all can be predicated.[1] In the undisturbed molars the hind edge of each tooth projects a little beyond the fore edge of the one behind it. This is the characteristic arrangement of the upper or maxillary teeth of *Iguanodon*. It is exemplified in the specimen figured in my second 'Supplement' to the Monograph on the genus (Palæontographical Society's volume for 1858, issued 1860), Pl. VII, fig. 2, in the undisturbed upper teeth, there marked *m*, *n*, *o*. The overlap by the anterior edge of the crown in the anterior four maxillary teeth of the posterior edge of the tooth in front, and the reverse arrangement in the rest of the maxillary series, where "the overlap seems to have taken place in the opposite direction," may be a character of *Hypsilophodon*, Huxley, but is certainly not a character of the present nor of any previous evidences of *Iguanodon*. In the small species discovered by Mr. Fox, as in the large type of the genus, the maxillary grinders not merely seem to overlap, but do so, in the way and degree exemplified in fig. 9, Pl. I, and in fig. 2, Pl. VII, of the former Monograph, above cited (Pal. Soc. vol. for year 1858), on the Iguanodon.

1 "The anterior four teeth are rather smaller than the others; and this is especially true of the first tooth. The anterior edge of the crown of each of these teeth slightly overlaps the posterior edge of the crown of its predecessor."—Huxley, loc. cit., p. 5.

Four or five teeth may have occupied the alveolar interspace between the foremost of the series of ten maxillary teeth and the second tooth from the premaxillary one, *i* (Pl. I, fig. 9). Sixteen teeth of the pattern characteristic of the upper molars of *Iguanodon* would thus occupy the extent of the alveolar border of the upper jaw preserved behind the pointed tooth(*i*). The maxillary is broken away behind such sixteenth molar. The small Iguanodon may, therefore, have resembled the large one, in number or 'formula,' as in the characteristic and peculiar generic pattern, of its teeth. The arrow (10) points to the tooth which is the subject of the magnified view (fig. 10). A comparison of this figure with a similar magnified view of an upper molar of *Scelidosaurus* ('Monograph of a Fossil Dinosaur,' &c., Pl. V, fig. 3[1]) shows the teeth of the two genera to be modifications of the same type. The exterior surface of the crown in *Scelidosaurus* (Pl. II, fig. 21) has a median and two marginal longitudinal elevations or ridges. The marginal ones diverge with the expansion of the crown, and end in points at its extreme breadth, rather more than half way between the base and apex of the crown. This apex and the points of the marginal ridges define a triangle, the converging sides of which are notched or serrate. The hollows between the medial and marginal ridges are smooth in *Scelidosaurus,* the anterior hollow is usually ridged in *Iguanodon.* In this genus the 'secondary' ridges are more feeble than the primary ones, and are plainly the seat of variety, as in the instances above cited. The upper molars of the small Iguanodon (Pl. I, figs. 9, 10) of the present Monograph exemplify the rule of the generic type: the first-cited figure of the two former Monographs shows the variety more approaching the type of the geologically older Dinosaurian (*Scelidosaurus*).

The molars of the Purbeck Dinosaur (*Echinodon,* Pl. II, fig. 22) repeat the pattern of those of *Scelidosaurus,* but the marginal serrations, being more numerous and relatively smaller, more resemble the serrations which Professor Huxley states "are so characteristic of the teeth of Iguanodon."[2]

The tooth, which I have referred, with probability, to the *Hylæosaurus,* shows the shape of crown on which the Scelidosaurian and Iguanodontal patterns have been superinduced; it expands from the base to two lateral angles, whence the sides converge to a third apical angle. If the converging borders of the terminal half of the crown had originally been notched or serrate, those projections had been worn away by use, in the tooth figured ('Monograph on the Fossil Reptilia of the Wealden Formations: Genus *Hylæosaurus*' in the Palæontographical Society's volume for 1856[3]). I may remark, also, that this tooth is a mandibular one, and that a nearer approach to the serrident type may have been shown in the maxillary teeth of the *Hylæosaurus.* Howsoever this may prove to be, the conformity of cranial structure, as of fundamental tooth-type, between *Scelidosaurus, Echinodon,* and *Iguanodon,* now exemplified by the small skull (Pl. I, fig. 9), makes it convenient to associate the genera in a section of *Dinosauria,* which may be termed '*Prionodontia,*' *i. e.* serrident, or saw-toothed.

[1] Pal. Soc. vol. for year 1859. [2] Loc. cit., p. 5. [3] P. 21.

In this family the skull exhibits a more generalised type of structure than in the existing *Crocodilia* and *Lacertilia*.

The short, square, massive character of the cranium, and the greater extent of ossification of the rest of its walls, are retained in modern *Crocodilia;* but the majority of the characters, as the double or divided external nostrils, the divided frontals, the relatively large orbits, the pterygoids divaricated by intervening basi-sphenoidal pterapophyses, and the separated palatines, are characters retained by modern Lizards. In the majority of existing Lacertian genera, however, the nasals form a single bone, and the premaxillaries are confluent anteriorly. These bones retain their parial condition in *Crocodilia* as in *Prionodontia*.

The position of the portion of lower jaw—left mandibular ramus—preserved in the block of matrix with the skull, precludes the procedures of exploration requisite for detection of teeth or germs of teeth, with any regard for the safety of the rest of this unique specimen, although the temptation is great, in reference to the alleged absence of an Iguanodontal characteristic, namely, the serrations of the free edge in the teeth of this specimen. Not that the allegation has any real value as to the generic character of the Saurian so represented; since it is plain that the remnants of the crowns of the upper molars are not such as could show the Iguanodontal serration if it had existed, the apical part being wanting where alone, as a rule, the crown is marginally serrate in the upper molars of *Iguanodon Mantelli*. In this species, moreover, the serrations are more numerous, and affect a relatively greater extent of the margins of the crown in the teeth of the lower jaw than in those of the upper. Hence it might be expected that the mandibular teeth of the small species from the Cowlease Wealden would apply a decisive test, on the assumption that the absence of marginal serrations—all other Iguanodontal characters present—was decisive against a generic relationship with Iguanodon.

Mr. Fox has kindly transmitted to me the portion of the left mandibular ramus, 1 inch 7 lines in length, with a depth of 7 lines, where entire, which is the subject of figs. 8—11 in Pl. II. It includes the sockets and fangs of eight teeth, so closely set as to have necessitated the overlapping arrangement of the crowns, according to the Iguanodontal type, the hind margin of the anterior tooth covering the outer side of the fore margin of the tooth behind, in the lower as in the upper jaws. The proportion of transverse to fore-and-aft diameters of the fractured bases of the mandibular teeth (fig. 8) in this specimen is also Iguanodontal, suggestive of a bruising function. These eight teeth occupy an alveolar extent of 1 inch 3 lines.

The outer surface of the ramus (ib., fig. 9) is divided into an upper and lower facet by a low, obtuse, prominent angle or ridge extending horizontally, and giving the greatest thickness to that part of the jaw; a series of five vascular or neuro-vascular foramina extends a little above this ridge. The structure of the outer surface of the ramus, exhibited by the larger jaw of a young Iguanodon, also discovered by Mr. Fox, in the same Wealden deposits of the south-west coast of the Isle of Wight, closely accords

with that shown by the present specimen (compare 'Monograph on the Fossil Reptilia of the Wealden,' Supplement No. 3, Pal. vol. for 1862, Pl. X, fig. 4, with fig. 9, Pl. II, of the present Monograph).

In like manner the inner surface of the smaller mandibular fragment (ib., fig. 10) shows a gentle convexity lengthwise and an almost level surface vertically, broken by a longitudinal groove near the lower border.

Concluding that, as in *Iguanodon*, the germs of successional teeth would lie on this side of the roots of the broken ones which had been in use, and that such germs would have the 'lanceolate and acuminate' portion of the crown, yielding the required test of conformity or otherwise in regard to marginal serration, I removed the inner (splenial) plate at parts which exposed three such germs (Pl. II, fig. 11, *a*, *b*, *d*), each demonstrating the character in question.

The inner side of the crown is traversed longitudinally by the submedial primary ridge, the coronal margin anterior to which shows four acute serrations, with grooves continued from their intervals some way down the surface. The extreme fragility of these precious evidences checked further attempts to expose more of that surface. My interpretation of the characters of the mandible and mandibular teeth, so far as they are exhibited by this specimen, is, that they demonstrate a reptile of the genus *Iguanodon*.

If the specimen belong to a full-grown individual, the greater relative size and the smaller number of the coronal serrations show it to belong to a distinct species of *Iguanodon*, for which the name of its discoverer is deservedly to be retained.

Still may remain the question whether, in the numerous successions of teeth which would ensue during the acquisition of the magnitude of *Iguanodon Mantelli*, the number of serrations might not be increased in greater proportion than the increase of the size of such serrations. That would be the sole modification needed to make them specifically as well as generically the teeth of *Iguanodon Mantelli*.

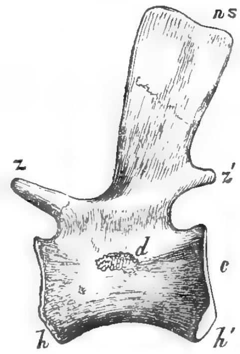
Of the above-described mandibular fossil Mr. Fox writes:—"This jaw was found within a yard of the skull. They were both in a mass of mud that had slided down from the cliff, and was being gradually washed away by the sea."

What is wanting in the exposed portions of the tooth-germs in the above specimen, viz. the continuation of the marginal serrations, of smaller size, upon the ridge bending from the margin at the broadest part of the crown upon the inner surface of the narrowing basal part of the crown, is fortunately supplied by an almost entire lower molar of *Iguanodon Foxii* (Pl. II, figs. 12—17), which came from a slab of Wealden stone containing a portion of a right mandibular ramus (Woodcut, fig. 1), with the symphysis, *s*, confined to the lower border of the sloping end (as at 5′, fig. 1, Pl. I); also a few ribs, a caudal vertebra of the pattern of those figured in Pls. VIII and IX

Fig. 1.

of the 'Monograph' on the Iguanodon of Pal. vol. issued for year 1854, and also "a distal phalanx of one of the toes." "I cannot tell," writes Mr. Fox, "where I have the bone itself, but its shape is exactly like that in *Iguanodon Mantelli*, very little curved in a downward direction, and rather broad.[1] In the little paper box, along with the fragment of jaw, you will find one very small tooth, quite perfect,[2] that came out of this slab in dressing."[3] This slab was found in the fallen cliff, about 150 yards east of "Barnes High," directly fronting the den of my *Polacanthus*, which I dare say you will remember seeing. The skull and broken jaw were found about 60 yards further eastward."[4]

Fig. 2.



In the accompanying Woodcut, fig. 2, of the caudal vertebra, nat. size, of *Iguanodon Foxii*, are added letters of reference corresponding with those on the figure of a caudal vertebra of *Iguanodon Mantelli* above quoted. The anterior or cervical vertebræ show the modification of the front ball and hind cup ('Monogr. on Wealden and Purbeck Dinosauria,' Part II, 1855, Tab. I, figs. 3, 4). If the sacral vertebræ should show the broad under surface, as in *s* 4, Tab. III, *Monogr. cit.*, a corresponding variability of vertebral shape in the same skeleton will characterise the present small kind of *Iguanodon* as it does the large kind.

The tooth (Pl. II, fig. 12) is 5 lines in length in a straight line; it is moderately curved, with the convexity (as the teeth *in sitû* above described show) towards the inner surface of the jaw, the sculptured surface of the crown having the same aspect. The length of the fang is 3 lines, that of the crown is 2 lines, but the apex of this has been broken off. The breadth of the crown is $2\frac{2}{3}$ lines; the thickness of its base $1\frac{1}{2}$ lines. The fang tapers to its implanted end, which is hollow and filled with matrix, subcircular in form, $\frac{1}{2}$ a line in diameter; the dentinal wall is here very thin. The fang expands towards the crown, chiefly in the antero-posterior direction, and is shorter on the outer concave than on the inner convex side, the coronal enamel descending rather lower on the outer side. The inner side of the fang is broader and less convex across than the outer side, towards which the fang seems to be, as it were, rather pinched in.

The outer side of the crown (ib., fig. 17, magn.) begins with a feeble rise of the enamel from the level of the fang, such rise describing a slight convexity downward; this side of the crown is gently concave lengthwise, more strongly convex across; it is relieved by low ridges continued down from the apices of the chief serrations, most of them subsiding before gaining the basal line. The finer serrations on each margin of the crown, where

[1] The shape and proportions of the ungual phalanges vary in the toes of the fore and hind feet in *Iguanodon Mantelli*.

[2] Letter received 4th February, 1870. [3] Ib. ib.

[4] Letter above cited. The skull and broken jaw are the subjects of figs. 9 and 9 *a*, of Pl. I.

it bends in from its broadest part, are conspicuous. Minute, short, irregular, longitudinal, linear risings of the enamel may be seen with the pocket lens in part of the interspaces of the longer and plainer ridges. The crown expands to its extreme fore-and-aft breadth about one third of its length from the fang.

The enamel on the inner side of the crown (ib. fig. 15, magn.) begins by a like definite rise from the level of the fang, but this runs straighter across before bending up to the margins of the expanding basal part of the crown. The continuation to the hinder border is more prominent and its termination is more abrupt, giving a slightly angular contour to that border, and making the surface of the crown between the border-ridge and the primary longitudinal ridge a little concave transversely. The basal rising subsides more quickly and completely upon the anterior border, which describes a gentle convex curve, and does not rise so as to render the inner surface of the crown between it and the primary ridge concave. Thus, the inner and outer sides of the crown being determinable by their difference of sculpturing, the fore and hind borders are shown by the above specified characters, and the detached tooth can be referred, as in the case of those of the larger *Iguanodon,* by like characters to its own ramus or side of the jaw; this, in the present tooth, is the right one. The inner side of the crown of this tooth of *Iguanodon Foxii*, as in the lower teeth *in situ*, has one chief median primary longitudinal ridge, increasing in strength from its origin at the basal rising of the enamel to the apex of the crown. On the front facet a short secondary ridge begins, next the primary one, near the apex of the crown, and terminates in the point or 'serration' next to that of the primary ridge. Another secondary ridge begins at the base of the crown, and runs nearly parallel with the primary one. The margin of the crown, anterior to this ridge, shows the usual smaller serrations. On the hind facet two secondary ridges commence at the up-bent part of the basal one, run parallel with the primary ridge, gaining in prominence and breadth, and terminate in the two stronger serrations behind the chief or apical one. Smaller serrations mark the hind border of the crown between the above and the end of the basal ridge.

Thus, all the complexities giving the generic characters of the lower teeth of *Iguanodon* are here manifested, as are those of the upper teeth in the skull (Pl. I, figs. 9, 10). The following differences from the larger teeth of *Iguanodon Mantelli* are of specific value: the defined rise of the basal border of the coronal enamel on both the outer and inner sides of the tooth, especially the latter; the relatively larger size and smaller number of the marginal serrations; the larger relative size and more definite median position of the primary longitudinal ridge.

The latter character, however, is reached in the range of variety to which the teeth of *Iguanodon Mantelli* are subject, as may be seen in the anterior 'acuminate and lanceolate' tooth in the Purbeck Iguanodon (Pl. I, fig. 8 *b*), and in the figs. 10, 15, 17, Plate VII ('Monograph on the Genus Iguanodon,' Supplement No. 2, Pal. vol. for 1858), exemplifying the characters of the upper and lower teeth of *Iguanodon Mantelli* and some of their varieties, due to age, wear, and position in the jaw.

From the above facts I conclude that the fossils discovered by Mr. Fox, and figured in Pls. I and II of the present Monograph, afford the much-needed exemplification of the cranial structure in the genus *Iguanodon,* and that they contribute to supply characters of the serrident family of *Dinosauria* which were not given in the fossil skull of *Scelidosaurus Harrisonii,* figured in Pls. V and VI of the Monograph on that Liassic Dinosaur, Pal. Soc. vol. for year 1859. The importance of this addition to the knowledge of Dinosaurian structures induces me to recapitulate and enforce the passing remarks, offered in the course of my descriptions, on statements which, if true, would leave such addition still a desideratum.

Serrations of the free edge of the crown, affirmed to be "*so* characteristic of the teeth of *Iguanodon*" (Huxley, *ut supra,* p. 5), are not in any degree characteristic of that genus. They are present in the teeth of older *Dinosauria* as of contemporary genera. The Liassic *Scelidosaur* and the Purbeck *Echinodon* alike manifest the modification. The true generic dental characteristic of *Iguanodon* is the superaddition to marginal serration of ridged and grooved sculpturing of one of the surfaces of the crown of the teeth; to wit, the outer one in the upper teeth, the inner one in the lower, the sculpturing being in so broad and definite a style that the ridges can be defined and distinguished. This character, combined with marginal serration, in the molars of the small Dinosaur in question, and this other character of the overlap of the expanded crowns in the one direction above described, are now submitted to impartial Taxonomists as the ground of the reference of the subject of the present section (§ 2) to Conybeare's genus.

So singular an anomaly in the arrangement of a molar series as the reversal of the order of overlapping at its two extremes might well support a generic distinction, but would need clear and indisputable demonstration for acceptance. *Iguanodon Foxii* affords no real ground for the ascription of such an anomaly.

As little does the fossil discovered by Mr. Fox support the assertion that its teeth have "no trace of the serrations on the free edge of their crown."

Prof. Huxley seems at one time to have been open to the evidence of the true character of the teeth in the unique skull from the Isle of Wight Wealden. But its discoverer had expressed his belief[1] that it might belong to a young Iguanodon, or to a new small species of that genus;—like the skeleton in which I had previously pointed out Iguanodontal characters.[2] So, in 1869, Prof. Huxley writes:—"A more critical comparison, however, has convinced me that the teeth of this reptile are perfectly distinct from those of the great Wealden Dinosaurian" (*ut supra,* p. 6). My own scrutiny, made in no critical spirit, but simply to find out the true state of the case, leads me to affirm these teeth to be specifically distinct, but not generically, from those of *Iguanodon Mantelli.* What the meaning of his term 'perfectly' may be, as predicated of this distinction, the author quoted nowhere defines.

[1] 'Proceedings of Sections, British Association,' Norwich, 1868.

[2] 'Monograph on the Fossil Reptilia of the Wealden and Purbeck Formations—Dinosauria (Iguanodon),' Palæontographical Society's volume for year 1854, p. 2, Pl. I.

In a subsequent Monograph on the parts of "other skeletons of the animal in the same locality," I may test the grounds of the ascription of the tibia and fibula of *Iguanodon Foxii* to the ischium and pubis, and of the hypothesis of its bird-like bipedal progression.

In concluding the present Monograph I would express the deep obligations under which Palæontology is under to the persevering explorations carried on, in brief intervals of leisure, by the Rev. W. Fox, M.A., in the locality which has benefited by his judicious and benevolent spiritual care and supervision.

[APPENDIX TO SUPPLEMENT NO. V MONOGRAPH ON *IGUANODON FOXII*, OW.]

SINCE the foregoing pages went to press, and long since the plates were completed and printed off, some additional observations have been recorded on specimens acquired from Mr. Fox's locality, which have been adduced in support of the title of my *Iguanodon Foxii* to generic distinction. The most important and decisive is that of my experienced fellow-contributor to the Monograph of the Palæontographical Society, Mr. BOYD DAWKINS.[1] *Hypsilophodon*, it appears, has seven digits in each fore-foot, and five developed ones on each hind-foot, whilst *Iguanodon* has but five digits on each fore-foot ('Monogr. Wealden Reptilia,' Supplement No. 4[2] (*Iguanodon*), 1872, Pl. III), and three developed digits on each hind foot (Ib. ib., Supplement No. 1[3] (*Iguanodon*), 1858, Pl. I). He justly, therefore, cites the distinction between *Hipparion* and *Equus* as warranting, or "sufficient for," the adoption of the same taxonomic distinction between *Hypsilophodon* and *Iguanodon*. It was unnecessary to remark (as the learned Society addressed by Mr. B. D. well knew) that two additional developed toes, with hoofs, are present in both fore and hind feet of the Miocene Horse, which toes are represented by splint-like rudiments of the metapodial elements in Pliocene and Modern equines, like the digit I in the above-cited plate of the Iguanodon's foot-skeleton.

Other observations, by Mr. HULKE, have not the same weight as those on the shape of the unequal phalanges of the fore-foot,[4] with me as those of Mr. Boyd Dawkins, seeing that some of the sacral vertebræ of the *Iguanodon*, those, *e.g.* marked $_s 4$ and $_s 5$ in the specimen of sacrum figured in Pl. III of my 'Monograph on Wealden Reptilia,' Part II[5] (*Iguanodon*), 1855, "are cylindroid and rounded below."[6] Such character might well be extended in a smaller species, but would not lead me to found thereon a generic distinction and name.

Moreover, in the series of eight vertebræ of which "the three last are firmly anchylosed, and the seventh and eighth form part of the sacrum," Mr. Hulke admits that "they are constricted in the middle, and their transverse processes, which spring from the junction of two vertebræ, are bent backwards, joining the dilated outer end of the transverse processes of the next vertebra, including a large subcircular loop."[7] This

[1] "Proceedings of the Geological Society of London," No. 273, November 19, 1873, 8vo (p. 2 of 'Abstracts').

[2] Palæontographical Society's volume for year 1871.

[3] Volume for year 1856.

[4] 'Quart. Journ. Geol. Soc.,' No. 116, June 25th, 1873, p. 528.

[5] Volume for year 1854.

[6] Proceedings, Nov. 19th ('Abstracts,' p. 2).

[7] Ib., ib., p. 1.

description might have been taken from the type example of the sacrum of *Iguanodon Mantelli,* figured in the Pal. Society vol. for 1855, above cited; and it adds to the satisfaction I feel in the additional knowledge of the osseous structure of the great herbivorous Dinosaur, which we may inferentially derive from the additional or better preserved parts of the smaller species; but which light it is sought to obscure by the *Hypsilophodon* curtain.

I have a strong belief and expectation that when specimens of the palatal structure of *Iguanodon Mantelli* are obtained they will resemble those of *Iguanodon Foxii,* figured in my Pl. II of the present Monograph, 'proved' and marked for 'Press' in June, 1873. The 'stout body' of the pterygoid is there shown in fig. 5 (*at* 24); the posterior process (*s*) joining the large 'pterapophysis' or basisphenoidal fork (*t*); the root of the branch (*a*), which Mr. Hulke[1] terms the 'quadratic process' = my 'tympanic process,' and the extension of the outer concave border to join the 'ectopterygoid' (*c*); also the separation, medially, of both pterygoid and palatines. Such, I repeat, may be expected to be, in the main, the palatal character of the great herbivorous Dinosaur. That expectation is further and strongly supported by the significant correspondence between *Iguanodon Mantelli* and *Iguanodon Foxii* in the characteristic and peculiar relations of the teeth to the jaws. "As in *Iguanodon Mantelli* the outer wall of the tooth-groove sends inwards partitions, which practically separate the teeth from one another, and must have afforded them a very firm support; but I doubt if these partitions actually reached the inner wall and became confluent with it."[2] I have no doubt, from the shape and length of the root or fang of the lanidriform tooth (Pl. II, figs. 19, 20, of the present 'Monograph') that it was "contained in a distinct separate socket." The difference, therefore, in the mode of implantation of teeth in the same jaw, as in the shape of vertebræ in the same sacrum, and in the shape of unequal phalanges in the fore and hind feet, are characters common to both *Iguanodon Mantelli* and *Iguanodon Foxii.*

R. O.

December 4th, 1873.

[1] 'Abstracts of Proceedings,' p. 1.

[2] 'Quart. Journ.' (June, 1873), p. 525.

PLATE I.

Genus IGUANODON.

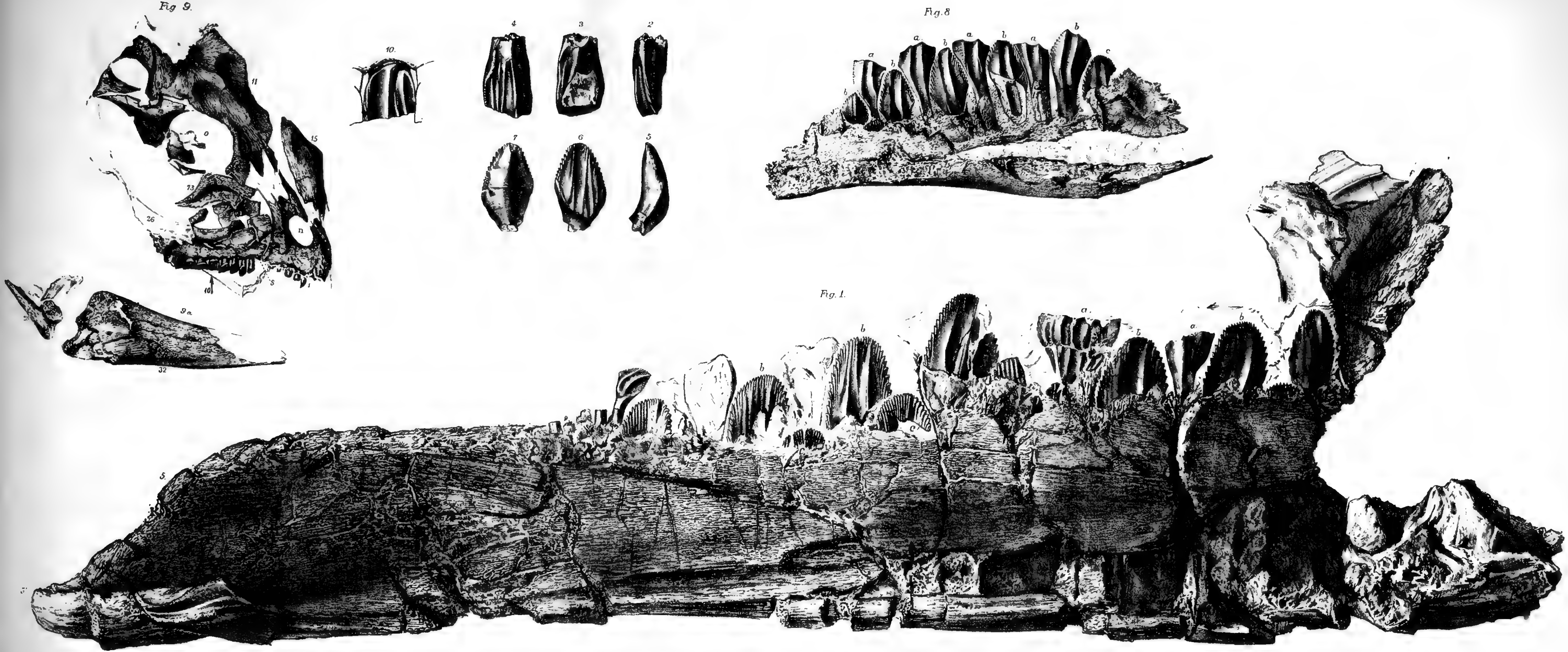
FIG.

1. Inner side-view of the dentary element of the right mandibular ramus, *Iguanodon Mantelli;* nat. size.
2. Anterior surface of a worn upper molar of a younger *Iguanodon Mantelli.*
3. Inner surface of the same tooth.
4. Outer surface of do.
5. Posterior surface of a lower molar of the same *Iguanodon Mantelli.*
6. Inner surface of the same tooth.
7. Outer surface of do.
8. Inner side-view of a portion of the right mandibular ramus of a younger *Iguanodon Mantelli;* nat. size.
9. Major part of the skull of *Iguanodon Foxii;* nat. size.

9 *a*. Portion of left tympanic and mandibular ramus of the same skull; nat. size (drawn without reversing).

10. Outer side-view of a worn, right, upper molar of the same skull; magn. 5 diams.

Figs. 1—7, from the Wealden Clay of Sussex, are in the Collection of S. H. Beckles, Esq., F.R.S., F.G.S., &c. Fig. 8, from the Middle Purbeck of Swanage, is in the Collection of A. J. Hogg, Esq. Figs. 9, 9 *a*, 10, from the Wealden of the Isle of Wight, are in the Collection of the Rev. W. Fox, M.A., of Brixton, in that island.



C.L. Griesbach del. et lith.

Mintern Bros imp.

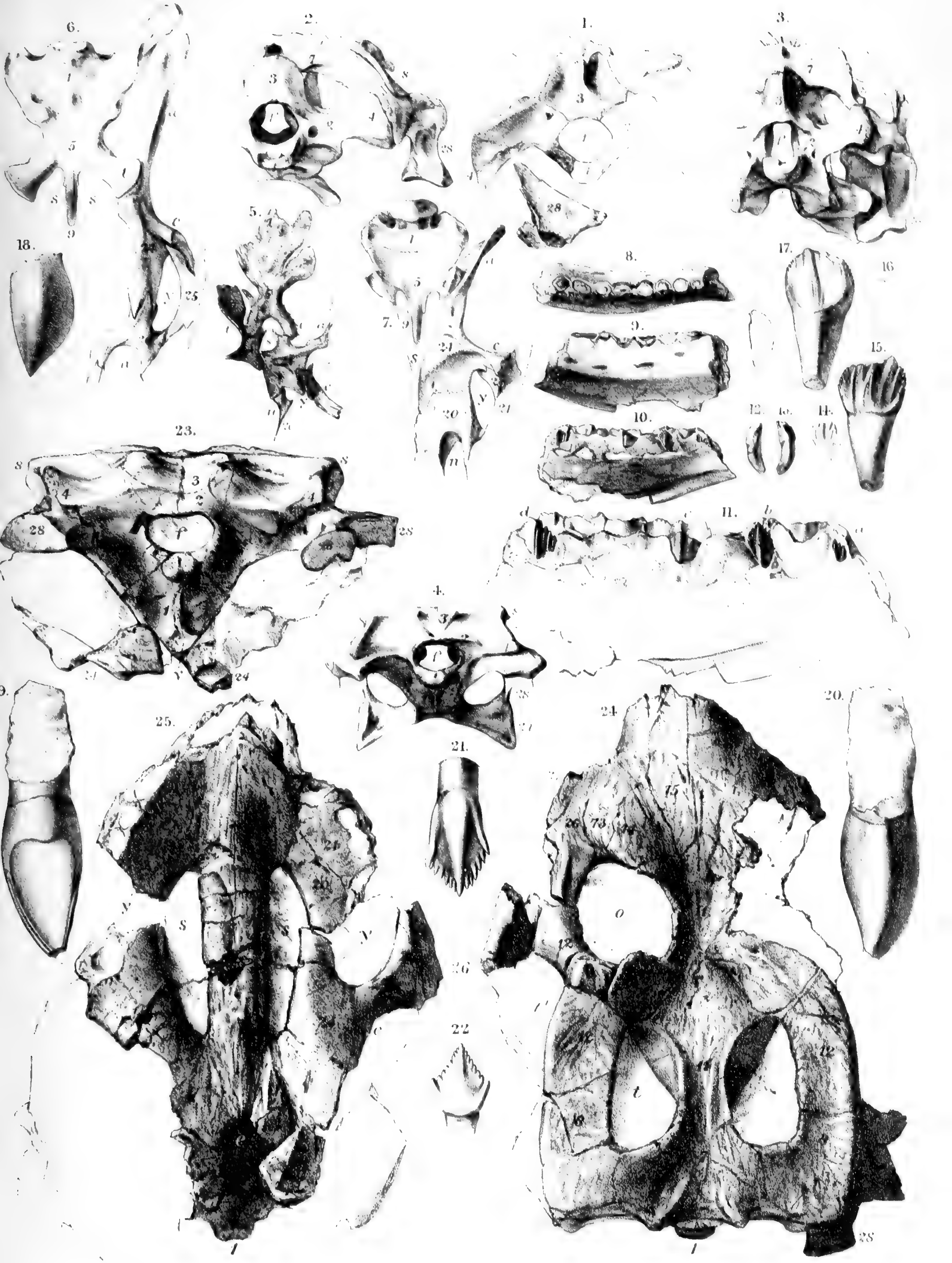
IGUANODON MANTELLI

PLATE II.

Genera IGUANODON and HYLÆOCHAMPSA.

FIG.				
1.	Occipital surface of skull, *Iguanodon Foxii.*			
2.	Do.	*Varanus salvator.*		
3.	Do.	*Iguana tuberculata.*		
4.	Do.	*Crocodilus acutus.*		
5.	Part of the base of the skull, *Iguanodon Foxii.*			
6.	Do.	*Varanus salvator.*		
7.	Do.	*Iguana tuberculata.*		
8.	Portion of right mandibular ramus, upper view, *Iguanodon Foxii.*			
9.	Do.	outer side view, do.		
10.	Do.	inner side view, do.		
11.	Do.	do.,	magn. 2 diams., do.	
12.	Mandibular tooth, fore side, *Iguanodon Foxii.*			
13.	Do.	hind side,	do.	
14.	Do.	inner side,	do.	
15.	Do.	do.	magn. $2\frac{1}{2}$ diams., do.	
16.	Do.	outer side, *Iguanodon Foxii.*		
17.	Do.	do.	magn. $2\frac{1}{2}$ diams., do.	
18.	Crown of upper laniariform tooth, *i*, outer side, magn. 5 diams., *Iguanodon Foxii.*			
19.	Upper laniariform tooth, inner side, half nat. size, *Iguanodon Mantelli.*			
20.	Do.	outer side,	do.	do.
21.	Upper molar, outer side, magn. 2 diams., *Scelidosaurus Harrisonii.*			
22.	Lower molar, inner side,	do.	*Echinodon Becklesii.*	
23.	Occipital surface of skull, nat. size, *Hylæochampsa vectianus.*			
24.	Upper surface of skull,	do.	do.	
25.	Under or palatal surface of skull, nat. size,	do.		

The fossils here figured, with the exception of figs. 19, 20, 21, 22, are from the Wealden of the Isle of Wight, and are in the Collection of the Rev. W. Fox, of Brixton, in that Island.



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THE

PALÆONTOGRAPHICAL SOCIETY.

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VOLUME FOR 1873.

LONDON:

MDCCCLXXIV.

MONOGRAPH

ON

THE FOSSIL REPTILIA

OF THE

WEALDEN AND PURBECK FORMATIONS.

SUPPLEMENT No. VI.

PAGES 1–7.

CROCODILIA (HYLÆOCHAMPSA).

[WEALDEN.]

BY

PROFESSOR OWEN, C.B., F.R.S.,

FOREIGN ASSOCIATE OF THE INSTITUTE OF FRANCE,

ETC. ETC.

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SUPPLEMENT (No. VI)

TO THE

MONOGRAPH

ON

THE FOSSIL REPTILIA

OF

THE WEALDEN AND PURBECK FORMATIONS.

(HYLÆOCHAMPSA.)

ORDER—*CROCODILIA.*

Genus—HYLÆOCHAMPSA, *Owen.* (PLATE II of SUPPLEMENT No. V, figs. 23, 24, 25.)

THE subject of the present 'Supplement' was discovered by the Rev. W. Fox, M.A., in the Wealden of the south-west coast of the Isle of Wight. It is the hinder part of a skull of a small or young Crocodilian, showing the occipital surface (Plate II, fig. 23), the upper openings of the temporal fossæ (ib., fig. 24 *t*) with the orbits ($_o$); and so much of the palate (ib., fig. 25) as permits of instructive comparisons with that seat of divers modifications in other *Reptilia.* A few sockets of teeth are shown at the hind end of both right and left maxillary bones.

These indicate the teeth to have been relatively as large as in *Goniopholis;* and, although it is hazardous to conjecture the shape of the crown of a Crocodilian tooth from the cylindrical root, as indicated by its socket, yet it seems to me probable that the teeth of the present small Crocodilian resembled more those of *Goniopholis*[1] than of *Suchosaurus*[2] or of *Poikilopleuron.*[3]

The outer surface of the cranial bones shows a different pattern of sculpture from that in *Goniopholis;* instead of small circular pits there are short irregular ridges, which, at some parts, the postfrontals, for example, have a tendency to diverge from a reticulate

[1] 'Report on British Fossil Reptiles,' 8vo, Part II, 1841, p. 69.

[2] Ib., ib., p. 67.

[3] Ib., ib., p. 84.

centre; a number of short ridges and clefts radiate from the raised part of the border of the temporal outlet; but all these accentuations of the surface are rather feeble.

As I know of no corresponding specimen of a skull of any Wealden Crocodilian like the present, and as it offers generic modifications of parts which are comparable with Crocodilians of older and newer formations, I propose to describe the specimen as representing a new genus and species under the name of "*Hylæochampsa vectiana*."[1]

The occipital surface (Plate II, fig. 23), excluding therefrom the tympanics, 28, and pterygoids, 24, is of a triangular form, with the base upward; the apex is pierced by the foramen, *v*. The breadth of this surface, taken at the mastoidean angles, 8, 8, is, to so much of the vertical diameter as includes the foramen, *f*, as three to one. The basioccipital, 1, contributes the middle four fifths of the condyle, the upper angles of which hemispheroid tubercle, due to the exoccipitals, are broken off. The centre of the condyle is feebly impressed; it projects, and is, as it were, sub-pedunculate. The basioccipital curves from the condyle forward and downward, then descends vertically to the foramen, *v*, and is ridged along the mid-line. The extent of the occiput below the foramen magnum, *f*, exceeds the part above the foramen. The exoccipitals, 2, are the largest elements of this cranial segment; they meet above the foramen, excluding the superoccipital, 3, therefrom for an extent of nearly three lines. The suture appears to be continued upward through the superoccipital, 3; but this may be due to fracture. The superoccipital develops a tuberosity at each upper angle, near its junction with the mastoid, 8. Each exoccipital swells at its outer border into two tuberosities, representing the paroccipitals of *Chelonia*, and contributing to the articulation for the tympanic, 28. The direction of the bilobed paroccipital border, 4, is oblique from above downward and inward. The tuberosity forming the angle of the mastoid, 8, projects distinct from the upper paroccipital one, 4.

In the relative extent of the paroccipital tuberosities and in the direction of their border *Hylæochampsa* resembles *Teleosaurus*, and differs from *Crocodilus*, in which the masto-paroccipital border extends from above downward and outward (ib. fig. 4), making the greatest breadth of the occipital surface to be at the paroccipitals, not at the mastoids.

There is no vacuity between the mastoid and superoccipital; a linear suture, slightly concave upward, alone divides them on the occipital surface.

The articular surface of the tympanic, 28, projects as usual, backward, beyond the plane of the occiput; the medial half only of that surface is preserved in the present fossil; it is almost vertical and very slightly convex.

The upper platform of the cranium behind the orbits (Plate II, fig. 24) is subquadrate, with the anterior angles rounded off. It is perforated by the pair of upper temporal openings, *t*, which are oblong-ovate, with the outer border almost straight, the inner one curved, and with the hinder or basal border slightly raised; the anterior border is depressed and continued upon the side of the cranium proper, forming the inner wall of

[1] Gr. ὕλη, wood or weald; χάμψα, an Egyptian name of the crocodile. The specific name relates to the locality of the fossil.

the temporal fossa. A flat surface of bone (8, 12), equalling the breadth of the temporal opening, lies exterior to it; a narrower concave tract (11) divides the openings; the posterior surface (7) is broader than the lateral ones.

In *Teleosaurus* and allied genera (e. g. *Metriorhynchus, Teleidosaurus, Steneosaurus, Pelagosaurus,* &c.) the upper temporal openings are relatively larger and the surrounding flat tract of bone is of less extent than in *Hylæochampsa,* which herein more resembles the tertiary and modern *Crocodilia,* although the form of the openings is teleosauroid.

The general form of the upper cranial surface posterior to the orbits resembles, in *Hylæochampsa,* more that in *Crocodilus, Metriorhynchus,* and *Pelagosaurus,* than that in *Teleosaurus cadomensis* and in *Gavialis,* in which latter the breadth exceeds the length.

The orbits in *Hylæochampsa* (Pl. II, fig. 24, *o*) are circular and better defined by the post-frontal (12) from the lateral outlets (*t'*) of the temporal fossæ than in *Crocodilus,* and herein they more resemble the orbits in *Teleosaurus;* but they are less horizontal than in *Tel. cadomensis,* and incline less to the vertical position than in *Tel.* (*Pelagosaurus*) *temporalis;* their outline is obliquely upward and outward. The prefrontal (14) and lacrymal (73) swell out a little anterior to the orbit, whence the maxillary (21) and nasals (15) continue to form the upper jaw. This recalls the character of that part of the skull in the Gavial rather than in the Crocodile.

These modern or procœlian representatives of the order *Crocodilia* differ from the *Lacertilia* in the greater extent or degree of ossification of the palate.

The 'pterygo-maxillary vacuity'[1] is large, and is bounded, as in Lizards (Pl. II, figs. 6 and 7, *y*), by the pterygoid (24), the ectopterygoid (25), the palatine (20), and, in most genera, *Iguana,* e. g., by the maxillary (21). But the 'palato-maxillary' vacuity[2] (figs. 6 and 7, *n*) between the vomer, maxillary, and palatine, does not exist in *Crocodilia;* nor is there a trace in that order of an 'interpalatine vacuity.'[3] The 'interpterygoid' vacuity in *Lacertilia*[4] appears to be represented by the much smaller opening which serves as the 'palato-naris,' or hinder orifice of the nasal air-passages in modern Crocodilian genera.[5]

In his description of the Caen Gavial (*Teleosaurus cadomensis,* Geof.) Cuvier indicates a large vacuity, more advanced in position than the hinder nostril of modern Crocodiles, and more resembling the 'interpterygoid vacuity' of Lizards (Pl. II, fig. 7, *s*). This he regarded in the Caen Gavial as the 'palato-naris.'[6]

[1] See my 'Anatomy of Vertebrates,' vol. i, p. 157, fig. 98, c, y; "grand trou palatin" of Cuvier, 'Ossemens Fossiles,' 4to, tom. v, pt. ii, p. 133, pl. vii, fig. 4 *r*; also "trou ovale assez grand," p. 259, pl. xvi, fig. 3, *Varanus niloticus.*

[2] 'Anat. of Vertebrates,' tom. cit., fig. 98, D, *n*.

[3] Ib., ib., fig. 98, D, *m*.

[4] Ib., ib., fig. 98, D, *s*.

[5] Ib., ib., fig. 98, C, *n*.

[6] "La fosse nasale postérieure;" described as "très-grande," and marked with the letter *s* in fig. 4, plate vii, 'Ossemens Fossiles,' tom. cit.

The smaller and more posterior orifice, resembling the 'palato-naris' of *Crocodilus* and *Gavialis*, and which DE BLAINVILLE and BRONN affirmed to be the true hinder nostril in the Teleosaurs, Cuvier calls "le trou des artères," and marks with the letter *t* in pl. vii, tom. cit.

The real nature of this foramen in the Teleosaurs is pointed out in my paper "On the Eustachian Canals in Crocodiles,"[1] and the accuracy of Cuvier's determination of the 'palato-nares' in the Teleosaur, is now accepted.[2]

In some Teleosaurians (*Tel. temporalis*, Bl., *Pelagosaurus typus*, Bronn) the 'palato-naris,' instead of being broader than long, as in *Tel. cadomensis*, is narrower and is produced forward into a point, on the same transverse parallel as the pterygo-maxillary vacuities, which are thus reduced in size and, as it were, pushed aside.

In *Hylæochampsa* (Pl. II, fig. 25) the vacuity (*y*) on each side of the bony palate is formed or bounded behind by the pterygoid (24) and ectopterygoid (25) and in front by the palatine (20), and probably by a small part of the maxillary (21), though here a portion of the antero-external part of the boundary is broken away. But sufficient remains to show that the vacuity is natural and is homologous with the "grand trou palatine" in *Teleosaurus cadomensis*, and with that called "grand vide palatine" or "trou palatine postérieur" by EUDES-DESLONGCHAMPS in *Teleosaurus temporalis* (*Pelagosaurus typus*); consequently with those which I have termed 'pterygo-maxillary' and symbolised by the letter *y* in my 'Anatomy of Vertebrates,' loc. cit. The vacuities in the interspace between the two 'pterygo-maxillary' ones, bounded externally by the pterygoids and palatines, answer to the "fosse nasale postérieure" of Cuvier in *Teleosaurus cadomensis*,[3] and to the "grande fosse ptérygoïdienne, qui limite en avant les arrière-narines" of Eudes-Deslongchamps in *Teleosaurus temporalis*;[4] consequently, also, to that which I have called 'interpterygoid' and symbolised by the letter *s* in *Iguana*.[5]

It is plain that the palatal or posterior opening of the nasal passages offers no trustworthy homological character in *Reptilia*. It is anteriorly situated in *Chelonia* and *Lacertilia*, where those passages are vertical or nearly so; it is at the hindmost part of the bony palate in modern Crocodiles, and in a more advanced position, though still in the hinder half of the palate, in the mesozoic or 'amphicœlian' Crocodiles. In each of these cases it has a distinct anatomical conformation. In *Chelonia* and most *Lacertilia* (*Varanus*, e. g.) its boundary includes parts of the vomer (13), palatine (20), and maxillary (21);[6]

[1] 'Philosophical Transactions,' 1850, p. 521, pls. xl—xlii.

[2] E. d'Alton and H. Burmeister, 'Ueber der Fossile Gavial von Boll in Wurtemburg,' &c., 8vo, plates in fol., Halle, 1854, in which the small hinder foramen is called "die vereinigten Mundungen der Eustachischen Röhren und gewisser Sinusse im Innern der Ossis occipitis."

[3] Tom. cit.

[4] 'Notes Paléontologiques,' 8vo, 1869, p. 146, pls. ix—xxiv, VI.

[5] Op. cit., fig. 98, D.

[6] Op. cit., fig. 98, B.

in *Iguana* it includes, with the same bones, also a part of the premaxillary; in *Crocodilus* proper it is wholly surrounded by the pterygoids; in *Teleosaurus* the palatines combine with the pterygoids to complete it anteriorly.

With regard to the opening answering to the hinder nostril in *Teleosaurus*, we find in *Varanus* that the halves of the divided vomer also contribute to bound or form the pointed anterior prolongation of the vacuity,[1] in the formation of which, as the pterygoids take the most constant and always the chief share in *Lacertilia* and *Chelonia*, and as the vacuity so bounded does not in these reptiles serve as the hinder or palatal opening of the nostrils, the term 'interpterygoid' appeared to me to be most conveniently applicable.

In the skull of the *Varanus niloticus* figured by Cuvier[2] the presphenoid is prolonged so as to seem to divide the 'interpterygoid vacuity' into a pair; the point of the bone, however, in nature inclines upward, and does not join anteriorly either the palatine or vomerine bones. In the larger monitor (*Varanus indicus*) and in *Iguana* the presphenoid (Pl. II, figs. 6 and 7, 9) has a like relation to the interpterygoid vacuity (ib., *s*), but is not so far produced.

Von Meyer, in his figure of the base of the skull of *Belodon Kapffi*,[3] represents the interpterygoid vacuity as divided by a longitudinal production, apparently, of the pterygoids, the lateral parts or plates of which form with the palatines the outer border of such vacuity. The homologues of the 'pterygo-maxillary vacuities' are much reduced in size, are external and posterior to the 'interpterygoid' openings, and are exclusively formed by the pterygoid and ectopterygoid, which, uniting externally to those openings as well as internally, are interposed between the maxillary and the 'pterygo-maxillary vacuity.' Von Meyer, as usual, puts no figures or letters of reference upon the bones and orifices, nor refers thereto by means of such symbols in his text.

Assuming, however, that the usually careful and accurate delineator of fossil specimens has correctly represented the palatal characters of his *Belodon Kapffi*, it offers the nearest resemblance to the characters of that part of the skull of *Hylæochampsa*.

In the proportion of this part of the skeleton of the Wealden Crocodile transmitted to me by Mr. Fox an extent of three inches of the hinder part of the bony palate is preserved (Pl. II, fig. 25). In this extent four vacuities are more or less completely shown; they are in two pairs. Of the medial pair (Pl. II, fig. 25, *s*, *s*) the left is entire, and the right lacks but a small part of its antero-external border; of the lateral pair (ib., *y*, *y*) the left wants a part of its antero-external border; but of the right, only a small part of the inner and hinder border is preserved.

The left pterygoid (24) is entire in its relations to the above vacuities, only the postero-lateral branch (answering to *a*, figs. 6 and 7) being broken off. The external branch (figs. 25, 6, 7, *c*), extends as usual, outward and forward to articulate with the ectopterygoid

[1] Cuvier, tom. cit., pl. xvi, fig. 3, &c. &c. [2] Ib., ib.

[3] 'Palæontographica,' zehnter Band, pl. xxxix, p. 227 (1863).

(ib., ib., 25); this abuts by its outer end against the hinder end of the maxillary (ib., ib., 21) and the contiguous part of the malar (ib., ib., 26), the fore part of the pterygoid (24) bounding with the ectopterygoid the hinder half of the pterygo-maxillary vacuity (*y*). The fore part of the pterygoid, continued along the inner border of that vacuity, articulates with the palatine (20), which, with the maxillary (21), completes the fore part of the boundary of *y*. We have thus the homologue of the 'great palatal opening' of CUVIER,[1] and of the 'posterior palatal opening' of EUDES-DESLONGCHAMPS in the *Teleosaurus cadomensis*,[2] which answers to the vacuity *y* in the *Lacertians*, figs. 6 and 7, Pl. II.

The medial pair of openings (Pl. II, fig. 25, *s*, *s*), bounded externally by the palatines and pterygoids, and internally, as it seems, by medial processes of the same bones, answer to the 'fosse ptérygoidienne' (VI) of EUDES-DESLONGCHAMPS in *Teleosaurus temporalis*,[3] and to the 'fosse nasale postérieure' of CUVIER in the *Teleosaurus cadomensis*.[4] But in *Hylæochampsa* this pterygoid fossa, or posterior nostril, is divided by so strong a longitudinal bony bar that the pair of vacuities might be taken at first sight to answer to the 'grands trous palatins' in the *Crocodilus rhombifer*.[5]

Such a determination is, however, incompatible with the coexistence of the vacuities (*y*, *y*) in *Hylæochampsa* and the concomitant recession of the maxillaries (21) from the outer boundaries of the openings(*s*, *s*, Pl. II, fig. 25).

We have thus another and most remarkable modification of the bony palate to add to those which have led that acute observer EUGENE EUDES-DESLONGCHAMPS to remark, in reference to the extinct *Crocodilia* of the Caen Oolite and other Mesozoic localities, "chaque espèce présente des modifications particulières."[6]

But although it may be admitted that the pair of medial openings (fig. 25, *s*, *s*) answer to the single medial opening (CUV., t. c., Pl. VII, fig. 4, *s*) in *Teleosaurus*, it does not absolutely follow that they served in *Hylæochampsa* the office of palato-nares. It might be contended that the small single orifice at the mid-line of the extreme hind border of the bony palate (ib., *e*) fulfilled that function, as the similarly sized and situated orifice performs in recent *Crocodilia*. The still smaller orifice (fig. 23, *v*) placed at the hind surface of the skull might in that case be homologized with the median Eustachian outlet,[7] and not with the vascular foramen,[8] in *Crocodilus*.

It should, however, be borne in mind that the true hinder nostril in procœlian

1 'Ossemen's Fossiles,' tom. cit., p. 133, pl. vii, fig. 4, *r*.

2 'Notes Paléontologiques,' p. 139, pl. xi, fig. 3, VII.

3 Ib., ib., pl. xii, fig. 10, VII.

4 Tom. cit., p. 133, pl. vii, fig. 4.

5 Marked *h* in fig. 2 of plate iii of the 'Ossemens Fossiles,' tom. cit., and marked *y* in 'Anat. of Vertebrates,' tom. cit., p. 157, fig. 98, c.

6 Op. cit., p. 147.

7 "On the Communications between the Tympanum and Palate in the *Crocodilia*," *ut supra*, pl. xl, fig. 1, *e*.

8 Ib., ib., *v*.

Crocodiles is divided by a pterygoid partition; although Cuvier makes the absence of this division, or inconspicuousness of the septum, a character of the skull of procœlian Gavials.[1] *Hylæochampsa* may show this partition in an exaggerated degree, and the orifices *s*, *s*, and not the orifice *e*, would be the hinder nostril.

Whatever alternative may commend itself to competent Palæontologists, the palatal characters which distinguish *Hylæochampsa* from all other known Reptiles, recent or fossil, are unaffected.

I have had no opportunity of studying the palatal characters in *Goniopholis*, *Suchosaurus*, or any other Wealden Crocodile than the subject of the present Monograph.

[1] "La cloison qui divise les narines ne se montre pas à leur ouverture postérieure." 'Oss. Foss.,' tom. cit., p. 106.

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MONOGRAPH

ON

THE FOSSIL REPTILIA

OF THE

MESOZOIC FORMATIONS.

PART I.

PAGES 1—14; PLATES I & II.

PTEROSAURIA (PTERODACTYLUS).

[GAULT—LIAS.]

BY

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FOREIGN ASSOCIATE OF THE INSTITUTE OF FRANCE,

ETC. ETC.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1874.

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J. E. ADLARD, BARTHOLOMEW CLOSE.

MONOGRAPH

ON THE

ORDER *PTEROSAURIA.*

HAVING in former Monographs on extinct volant Reptiles defined species (*e. g. Pterodactylus compressirostris, Pter. Cuvieri,* &c.)[1] from the Upper Chalk, and others (*e. g. Pterodactylus macronyx*) from the Lower Lias,[2] I propose to add to the present Monograph a brief account of evidences of *Pterosauria* which have reached me from intervening formations of the Mesozoic period.

§ 1. PTEROSAURIA FROM THE 'GAULT' (Plate I, figs. 5 and 6).

I commence with one from the deposit called 'Gault,' at Folkestone, which is intermediate in age between the Upper and Lower Greensands, from the former of which Pterosaurian remains, remarkable for their great size (*Pterodactylus Sedgwickii, e. g.*), have been described and figured in the Society's volumes.[3] Examples of the winged order of Reptiles from the present formation have hitherto been very scanty. The first that has been submitted to my examination is the subject of the following description, and represents the undernamed species.

[1] 'Monograph on the Fossil Reptilia of the Cretaceous Formations,' Order PTEROSAURIA, Palæontographical Society's vol. for year 1851, issued in 1851, p. 80, Pls. XXVII, XXVIII, XXX.

[2] 'Monograph on the Fossil Reptilia of the Liassic Formations,' Order PTEROSAURIA, Pal. Soc. vol. for year 1869, issued in 1870, p. 41, Pls. XVII—XX.

[3] 'Monograph on the Reptilia of the Cretaceous Formations,' Supplement I (PTEROSAURIA), Pal. Soc. vol. for year 1857, issued in 1859, p. 1, Pls. I—III.

A.—*Pterodactylus Daviesii*, Owen.

Symphysis Mandibulæ, and Teeth (Plate I, figs. 5 and 6).

That this fossil, which is figured of the natural size from the lateral (fig. 5) and oral (fig. 6) surfaces, is the fore part of the symphysis of a lower jaw, and not that part of the palate of the upper jaw, is shown by the medial groove in place of the medial ridge on the surface of the bone which was next the mouth, which surface is here on the upper part of the bone and may have served to lodge and facilitate the movements of a cylindrical protrusile tongue. The character of the palatal surface of the upper jaw is exemplified in *Pterodactylus Cuvieri* (Monogr. cit., 1851, Pl. XXVIII, fig. 4); in *Pterodactylus compressirostris* (ib., ib., fig. 10); in *Pterodactylus Sedgwickii* (Monogr. cit., 1859, Pl. I, fig. 1 *b*); and in *Pterodactylus clavirostris* (Pl. I, fig. 4, of the present Monograph). The grooved character of the oral surface of the mandibular symphisis is shown in *Pterodactylus Sedgwickii* (Monogr. cit., Pl. I, fig. 2 *b*).

The angle of convergence of the two rami of the lower jaw to the symphysis in *Pterodactylus sagittirostris* (Pl. II, fig. 8) renders it improbable that the sides of that symphysis would run parallel for the extent shown in Pl. I, fig. 6, or that the symphysis would terminate so obtusely. Moreover, the five pairs of sockets, with bases of teeth, in the fossil representing *Pterodactylus Daviesii*, indicate teeth of smaller size and closer disposition than in the mandible of *Pterodactylus sagittirostris*. The foremost pair of sockets (ib., figs. 5 and 6, *a*) are less elliptical than the rest. The base of the tooth retained gives an almost circular section; the outlet of the socket is directed more obliquely outward than those of the others, and the crowns of the teeth were, probably, more divaricated in this foremost pair. The sections of the bases of the teeth in the sockets *b*—*e* give a fuller ellipse than the outlet of the sockets themselves. The outer surface of the bone is smooth and even, the upward curve from the under margin of the symphysis is gradual, as shown in fig. 5.

This specimen was discovered in the 'Gault' at Folkestone, by Mr. William Davies, of the British Museum, to whom, in acknowledging much useful assistance, I have pleasure in dedicating the species of Pterodactyle indicated by the present fossil.

§ 2. Pterosauria from the Wealden.

A.—*Pterodactylus sagittirostris,* Owen (Plate II, figs. 1—8).

The type of Cuvier's genus *Pterodactylus* is the species which he calls *longirostris.* The chief generic character is the extreme length of the fourth digit of the fore-limb.[1]

The *Pterodactylus longirostris,* Cuv., is characterised, as the term implies, by long, slender, tapering jaws, armed along their anterior half by numerous long, slender, pointed, separated, and pretty equally distant teeth.

In a general way the portions of mandible about to be described repeat these characters. The mandibular teeth appear to have been about the same in number. Nineteen are reckoned by Cuvier to have occupied the dentigerous part of each mandibular ramus in the type-species;[2] and about as many appear to have armed the same part as *Pterodactylus sagittirostris.*

There is as little trace of condyloid or coronoid processes in the present Wealden Pterodactyle as in the Oolitic longirostral species.[3]

The great and rapid addition to the number of extinct flying Reptiles having the characters of Cuvier's genus *Pterodactylus* has led to its subdivision into several groups or subgenera.

If length of tail with number of caudal vertebræ be accepted as a generic character, those that have that appendage long, and supported by more than thirteen vertebræ, must go to a different group from that including the *Pter. longirostris.*[4]

It is plain that *Pter. sagittirostris* has not the generic dental characters of *Dimorphodon.* It is probable that the symphysial modification which supports the generic name *Ramphorhynchus* was not present.

If the skull of the long- and sharp-jawed Wealden species, or of that from the Upper Chalk which I have described under the name of *compressirostris,* should ultimately be found to offer marked differences in the forms, sizes, and proportions of the narial, orbital, and intermediate vacuities, from those figured by Cuvier in pl. xxiii (op. cit.), it may be deemed requisite to refer them to a distinct pterosaurian group. At present it appears to be convenient to place the sagittirostral and compressirostral with the typal species in the Cuverian genus *Pterodactylus.*

[1] "Un genre de Sauriens, caracterisé par l'excessif allongement du quatrième doigt de devant, auquel nous avons donné le nom de Pterodactyle."—'Ossemens Fossiles,' tom. v, pt. ii, 4to, 1824, p. 358.

[2] Cuvier, tom. cit., p. 364.

[3] Ib., ib.

[4] In which Cuvier describes the tail as "très-courte, très-grèle, et l'on n'y compte que douze ou treize vertèbres."—Tom. cit., p. 368.

The most striking characteristic difference from that species is the vastly superior size of the seemingly allied Flying Dragons from the British Chalk and Wealden.

In the restoration of the skull of *Pterodactylus compressirostris* ('Monograph on the Fossil Reptilia of the Cretaceous Formations,' 4to, Part I, 1851, Palæontographical Society's vol. for 1851) I ventured to assign to the mandible a length of 14 inches 9 lines (Pl. XXVII, fig. 5). This species was represented by two portions of the upper jaw (ib., Pl. XXVIII, figs. 8, 9, 10) from the Middle Chalk of Kent, the longest portion being 4 inches in length. Of the nearly allied species, represented by three portions of the lower jaw, discovered by SAMUEL H. BECKLES, Esq., F.R.S., F.G.S., in the Hastings series of the Wealden Formation, west of St.-Leonard's-on-Sea, the restoration figured of half the natural size in Plate II, fig. 8, gives a mandible of between 14 and 15 inches in length, and this on the most moderate estimate of the length of the symphysis. In a sketch of a restoration of the jaw, sent to me with the fossils by Mr. Beckles, the length of the symphysis, which he assigns on the basis or analogy of that in Collins's or Cuvier's *Pterodactylus longirostris* gives a total length of 18 inches to the mandible.

The parts obtained by Mr. Beckles are of one and the same lower jaw; and, as an extent of above 2 inches of both rami are maintained by a portion of matrix (Pl. II, fig. 8, *m*) in their natural relative position, the angle of convergence is shown; and this affords a ground for estimating the length of each ramus from the articular surface to the hind part or border of the symphysis at 13 inches, the extent beyond remaining conjectural.

The specimen includes a portion of the left ramus, 9 inches 8 lines in length (of which the anterior 7 inches are given in Pl. II, fig. 1), and two portions of the right ramus, of which the dentary part measures 5 inches (ib., fig. 2) in length, the articular part 2 inches (ib., fig. 5).

The portion of the left ramus includes the dentary element (ib., fig. 1, and fig. 4, 32) with the anterior part of the splenial element (fig. 4, 31). The dentary includes ten of the hinder sockets (ib., fig. 1, 1, 2, 3, 4, 5), of which the five foremost (ib., 6, 7, 8, 9, 10) retain more or less of their teeth. As the number of these which may have been present in the fore part of the jaw is unknown, I count those which are preserved from the hind end of the series forwards. Prolonging the alveolar border according to a moderate estimate of the symphysis, and supposing the teeth to maintain the same intervals, about eighteen may be assigned to each ramus.

The border of the hindmost socket (fig. 1, 1) is not prominent as in the rest, and there is room for doubt whether the oval vacuity which indicates the hindmost tooth really contained one. There is none, however, with regard to the next socket (ib., 2), for this, like the antecedent ones, rises at its outlet above the level of the surrounding part of the bone. It projects from the outer part of the thick, transversely convex, upper border of the dentary, and the course of the cavity shows that the tooth must have inclined somewhat outward as well as forward from the perpendicular. The long diameter of the

outlet is in the axis of the jaw, and is $1\frac{1}{2}$ lines (3 m.m.). The short or transverse diameter is 1 line (2 m.m.). The interval between this socket and the one marked 3 is 5 lines (10 m.m.).

The prominent outlet of the socket 3 gives 5 m.m. in long diameter and 3 m.m. in short diameter; these dimensions with that of the interval are repeated to the socket 6, which retains its tooth. The exserted crown of this is 5 lines (10 m.m.) in length; it is conical, acute, gently curved, with the convexity outward and forward.

The apex of the next tooth in advance is broken off, but the basal half is better cleared out of the matrix, giving an antero-posterior breadth of its issue from the socket of 5 m.m.

The teeth in the sockets 8 and 9 are better preserved, and show well the characters of the mandibular ones in the present species.

As in *Pterodactylus longirostris,* the teeth of *Pter. sagittirostris* are subsimilar, divided by nearly equal intervals, these being somewhat wider than in *Pter. longirostris,*[1] relatively shorter than in *Pter. crassirostris,*[2] and more resembling in disposition the indications given by the sockets in the portion of upper jaw of the Cretaceous *Pterodactylus compressirostris.*

The dentary bone supporting the above-numbered teeth is slender and subcompressed; its depth is given in figs. 1, 2, and 4 (nat. size); its thickness is shown in fig. 3.

This is the same at both upper and lower borders, which are similarly rounded off; it is less half way down, owing to the concavity, vertically, of the inner surface of the ramus (ib., fig. 4). The outer surface (fig. 1) is nearly flat; it is traversed lengthwise by a linear impression, which is 5 m.m. below the upper border at the hind end of the proportion of the ramus figured in fig. 1, and is 7 to 8 m.m. below the outlets of the sockets of the teeth 7—9. This linear impression does not indicate a suture.

The ramus slightly increases in thickness, with a gain of convexity externally and a deeper concavity internally (both being in the vertical direction), at the fractured end (ib., fig. 1, 32) nearest the symphysis. At the opposite end the angular element (ib., fig. 4, 30) forms the inwardly prominent lower border; the line between which and the thin flat splenial forms (ib., ib., 31) is clearly sutural.

The portion of the right dentary preserved (Pl. II, figs. 2, 3) answers to that containing the sockets of the teeth numbered 2—9 in fig. 1. There is the same obscurity or lack of demonstration of a socket or tooth behind the socket 2.

The bases of the teeth are preserved in the sockets (numbered 2—6), and partly project from the sockets 2 and 3, but the sockets 7, 8, 9, are vacant.

The articular portion of the right ramus (figs. 5, 6, 7) lacks the prominent, backwardly directed, end of the subangular (30).

1 Monograph above cited, Pal. Soc. vol. for year 1851, Pl. XXVII, fig. 1.

2 Ib., ib., figs. 2 and 3.

The articular concavity (fig. 6, *a*) is transversely extended, chiefly by the production of its inner wall (ib., *b*); its upper boundary is sinuous by a backward production of its mid part; the upper surface in advance of the cavity is smooth and gently convex across it narrows to the ordinary thickness of the ramus about an inch and a half in advance of the articulation. In this extent it shows no trace of a coronoid rising. The inner surface is impressed with a deep longitudinal cavity (ib., fig. 7, *c*).

According to the usual proportions of the upper and lower jaws of Pterodactyles, the premaxillary of the present species must have been twice, or nearly twice, the depth or vertical diameter of the portion of that bone of *Pterodactylus compressirostris* (figured in Pl. XXVIII, fig. 8, of Monogr. cit.). Both upper and lower jaws of *Pterodactylus sagittirostris* must have been broader, less compressed, than in the Cretaceous *Pter. compressirostris*.

The value of a symphysis mandibuli, with its natural anterior termination, like that of the Gault species (*Pterodactylus Daviesii*), is its demonstration of a character determinative of the genus of Pterosaurian. Were it produced into a slender-pointed edentulous style, or 'rostrum,' it would lead to a reference of the species to Von Meyer's genus *Rampho-rhynchus* and Family '*Subulirostres*.'[1] The opposite extreme is shown by the thick obtusely terminated snout, as if it had been cut short, giving the character of the Ptero-saurian family *Truncirostres*.[2] The species of this family which have the foremost pair of teeth projecting forward in the upper jaw from the truncate surface at a higher level than the alveolar border form the genus *Coloborhynchus*.[3]

B.—*Coloborhynchus clavirostris*, Owen (Plate I, figs. 1—4).

In two species of these large Pterodactyles from the Cretaceous series, viz. *Colobo-rhynchus Cuvieri*, from the Middle Chalk of Kent,[4] and *Coloborhynchus Sedgwickii*,[5] from the Upper Greensand of Cambridge, the anterior pair of teeth of the upper jaw project, as

[1] 'Palæontographica,' Heft i, 4to, 1846.

[2] Mihi (*Truncus*, cut short).

[3] κολοβὸs, stunted; ῥύγχοs, snout. I have no evidence, and Mr. Seeley gives none, of such departure from the Pterosaurian type of hand as would justify the term *Ornithocheirus* proposed by Mr. Seeley for *Pterodactylus Sedgwicki* in his 'Ornithosauria,' 8vo, 1870, p. 112; or the term *Ptenodactylus* previously proposed by Mr. Seeley for the same Pterodactyle in the 'Index to the Fossils, &c., in the Woodwardian Museum,' 8vo, 1869, p. xvi.

[4] 'Monograph on the Fossil Reptilia of the Cretaceous Formations,' Part I (Palæontographical Society's volume for year 1851), p. 88, Pl. XXVIII, figs. 1—7.

[5] Ib., ib., 4to, Supplement No. I (Palæontographical Society's volume for year 1857), p. 2, Pl. I, figs. 1, *a*—*d*.

in the present species, from the fore part or end of the premaxillary, and are directed forward with a slight downward curve.

In a still larger species (*Criorhynchus simus*[1]), from the Upper Greensand of Cambridge, the foremost pair of teeth project from the under surface of the fore end of the premaxillary, and are directed downward like the following teeth. The fore end of the premaxillary was fortunately entire, showing a flattened or feebly concave tract corresponding to the part bored by the anterior alveoli in *Coloborhynchus*. Some reserve may be prudently entertained as to whether a pair of teeth so anomalously located as in *Coloborhynchus* might not be shed without replacement by successors; and the genus *Criorhynchus* is to be accepted with this reserve, which future discoveries may dissipate. The manifestation by a 'truncirostral' Pterodactyle of the Wealden, and by another from the 'Greensand,' of the produced and unopposed pair of teeth from the front surface of the muzzle, have dissipated the doubts as to its accidental and individual character which legitimately attached to the first specimen, from the Chalk, in which it was observed.

Coloborhynchus clavirostris is, at present, represented by the fore part of the upper jaw of a Pterodactyle (Pl. I, figs. 1—4) from the Wealden, of equal size with *Criorhynchus simus*, from the Upper Greensand, but in which the small anterior pair of premaxillary teeth project from the front surface of the bone, and at a greater elevation above the palate and the sockets of the second pair, than in *Coloborhynchus Cuvieri* or *Colob. Sedgwickii.*

The flattened fore part of the premaxillary (ib., fig. 2) is broader and of less height in *Coloborhynchus clavirostris* before the narrow upper surface (*g*) begins to slope backward to the upper contour of the cranium. The anterior median depression (*h*) is shorter vertically and deeper in *Colob. clavirostris*, where it is below the alveoli of the teeth (*a, a*). The convexities (*i, i*) on each side of this depression are the fore parts of the sockets of the second pair of teeth, not of the first pair, as in *Criorhynchus simus* (Monog. cit., Pl. I, fig. 3, *a*). The sides of the fore part of the premaxillary in *Coloborhynchus clavirostris* converge, with a slight vertical concavity, to the narrow but obtuse upper border of the skull; the same sides also converge as they recede in a slighter degree, but so that the breadth of the upper jaw behind the sixth pairs of teeth (ib., figs. 1 and 4, *f, f*) is less than two thirds the breadth behind the second pair of teeth (ib., *b, b*, fig. 4), whence the name *clavirostris* ('club-snout') proposed for the present formidable species of Wealden Pterodactyle.

The fore part of the bony palate, between the teeth of the second pair (ib., fig. 4, *b, b*), is transversely quadrate and flat (ib., fig. 4, *k*). Behind this tract the mid third only of the palate retains its level, the two side thirds subsiding (as it seems when looked down upon) into shallow channels, which expand and are continued into the slope rising

[1] Ib., ib., 4to, Supplement No. III to 'Monograph on the Fossil Reptilia of the Cretaceous Formations,' PTEROSAURIA, p. 2, Pl. I (Palæontographical Society's volume for year 1858).

to the sockets of the fifth ($_e$) and sixth ($_f$) teeth, leaving the prominent narrow mid tract to represent, as it were, the bony palate; this part has projected below the level shown between the fourth pair of teeth, behind which the thin compact wall is broken away, exposing the widely cellular structure. A similar abrasion affects the upper border of the skull (beyond *i*, fig. 1, Pl. I).

The first or anterior pair of teeth (ib., $_a$, $_a$) bears the same relations of size to the second (*b*) and third (*c*) pairs as in *Criorhynchus simus*, and may be homologous with the first pair in that species (Monog. cit., Pl. I, fig. 1, $_a$) though differing so much in position and direction. In the present specimen of *Coloborhynchus clavirostris* the crown of the first, as of the second, tooth is broken off at the outlet of the socket. The shape of this outlet is a full ellipse (Pl. I, fig. 2, $_a$, $_a$); the long diameter, of 8 m.m., is vertical; the short diameter, of $6\frac{1}{2}$ m.m., is transverse. The size and shape of the five following teeth are shown in fig. 1; for, as is common in Pterodactyles, the sockets open obliquely upon the outer part of the alveolar border, and in the present species with a nearer approach to verticality than is usual (compare Pl. I, fig. 1, with Pl. I, fig. 1, of the Monograph of 1858, in the Pal. Soc. vol. issued in 1861).

The present unique evidence of one of the most extraordinary of the extinct order of volant *Reptilia* was discovered by S. H. Beckles, Esq., F.R.S., in the Hastings Series of the Wealden.

§ 3. Pterosauria of the Kimmeridge Clay.

A.—*Pterodactylus Manselii*, Owen (Plate I, figs. 10, 11, 12, 20, 21).

Figures 10 and 11 of Pl. I show front (thenal) and back (anconal) views of a mutilated proximal end of the left humerus of this rather small species of Pterodactyle. The reniform articular surface of the head of the humerus (fig. 12, ^{a}) is somewhat less extended transversely in proportion to its breadth than in a similarly sized species from the Lias (*Pterodactylus Marderi*, ib., fig. 9); its anconal convex border has a bolder curve. There is no indication of a pneumatic orifice on this surface, as in Birds. The pectoral process (*b*, figs. 10 and 11) stand out more abruptly from a less extended base (compare with *b*, figs. 7 and 8, Pl. I).

The proximal end of the first phalanx of the fourth or wing-finger, which is the subject of figs. 20, 21, 21^x, corresponds in size with the portions of humerus above described, near which they were discovered. The olecranoid process (ib., fig. 21, $_c$) led observers of the first discovered specimens of this eminently pterosaurian bone to regard it as an ulna. Upon this process is extended part of both the outer and inner concave articular surfaces, so placed as to resemble the two divisions of the 'greater sigmoid

cavity' in the human ulna, the curve and depth of which surfaces is thus augmented, and therewith the security of the flexible joint on which the chief movements of the bat-like wing take place. The outer surface, shown in fig. 20, is of less extent, in long diameter, than the inner articulation (ib., fig. 21, *a*); a larger proportion of it is supported by the olecranoid process; and it is better defined along the margin next the longer concavity (*a*). Nevertheless, the smoothness of the surface of the ridge, dividing the concave articulations, suggests that they combined to form a single synovial hinge-joint or 'ginglymus,' limiting the movements of the bones so articulated to one plane, and combining freedom and extent of motion in that plane with great strength of joint. The summit of the olecranoid process in the present specimen shows a rough flattened surface, not a fracture, suggestive of the contact of a sesamoid, probably lodged in the tendon inserted into the phalanx (ib., fig. 21[x]).

B.—*Pterodactylus Pleydellii*, Owen (Plate I, figs. 15, 16, 22, 23, 23[x]).

The portion of the fossil skeleton of the small species of Kimmeridgian Pterodactyle here figured is the distal half of the left humerus. It shows the generic obliquity and superiority of size of the articular convexity for the head of the radius (ib., fig. 15, *a*,); that for the ulna has suffered fracture, and part of it is lost with the ulnar tuberous ridge; but sufficient remains to show its hemispheroid form, and the mere chink dividing it from the radial condyle instead of the groove which is here seen in Birds. The flexor (?) ridge, leading to the broken tuberosity, extends more forward than in *Pterodactylus Duncani* (ib., fig. 13), and contributes to a deeper concavity above the condyles on the thenal aspect of the distal expansion of the humerus. The transverse ridge behind the condyles is confluent therewith at its extremities, the defining groove not being developed (ib. ib., 16′). The broad shallow canal for the 'triceps' tendon marks the anconal surface of this expansion (ib., fig. 16).

To the same species of *Pterodactyle* may probably belong the proximal end of the smaller example of the first phalanx of the fourth or wing-finger, of which I have given two views in Plate I, figs. 22, 23, and 23[x], to contrast with those of the same bone and part of *Pterodactylus Manselii*. The olecranon process in *Pterodactylus Pleydellii* is relatively longer and more incurved; its apex is not truncate; it is more compressed; has a smaller and lower posterior tuberosity, and a smaller basal tuberosity. The longer concave articulation is similarly extended upon the anterior angle. From the tuberosity at the corresponding or lower end of the shorter concavity a ridge is continued down the bone, giving a triedral form to the shaft as far as it is preserved in this and the previously described specimen (figs. 20, 21). The bony wall of the shaft is thin and compact, the air-cavity large, and in one specimen occupied by crystallised calcite.

The two narrower sides are concave or flat transversely; the broader side is gently convex; it shows, in both species (figs. 21, 23), a longitudinal linear impression, which may indicate a confluent rudiment of a fifth digit.

To the above-described, well-defined, trochlear or ginglymoid joint were adapted the two obliquely disposed condyles of the distal end of the metacarpal of the fourth or wing-finger.

I have pleasure in contributing this mite of testimony to the unremitting attention to the fossil evidences of Kimmeridgian Vertebrates, discovered from time to time on his estates by John C. Mansel-Pleydell, Esq., F.G.S., of Longthorns, Blandford, and to the wise liberality by which they have uniformly been deposited in the National Collection, where inferences and conclusions from their study can be tested by Palæontologists.

C.—*Pterodactylus*, sp. incert.

Two specimens of the carpal bone, provisionally referred in my Monograph of 1857 to a Pterosaurian '*unciforme*,'[1] are figured in Plate I, figs. 24—27. They were both obtained from the "Kimmeridge Clay," at Weymouth, Dorsetshire.

The distal surface of the smaller specimen is given in figure 24; they show the larger concavity (*a*), and the smaller one (*b*), adapted to the two proximal condyles of the metacarpal of the wing-finger. The thenal border of the bone is the thinnest, and is produced at each end into a short process; the anconal border of the bone is thicker, especially where it supports the smaller and outer articular metacarpal concavity.

The proximal surface (ib., fig. 25) is also divided into two principal articulations, but the larger one (*c*) is subdivided into a concave and a flattened facet. The smaller concave surface (*d*) is next the outer and thickest end of the bone.

The subject of figs. 26 and 27 is the homologous bone, and from the forelimb of the same side, but it shows modifications that plainly bespeak its having come from a distinct species of Pterodactyle. The outer subhemispheric concavity of the proximal surface (ib., fig. 27 *d*) is relatively larger, as is likewise the flat facet at the inner part of the larger surface (*c*). The two condylar concavities (*a* and *b*) on the distal facet are more equal than in the larger unciforme.

Both bones exemplify the definite, well-marked, or finished character of the articular surfaces which characterise the bones, especially those of the wing, of the volant Reptile.

I would still be understood to be guided by considerations, not beyond probability, in referring this well-marked bone to the distal row of the carpal series; for I have not

[1] Palæontographical volume for year 1857, issued in 1859, plate iv, figs. 5 and 6.

yet had the opportunity of studying a Pterosaurian carpus or tarsus in so well-preserved and undisturbed a condition as would enable me, with certainty, to determine the homologies of its constituent bones.

§ 4. Pterosauria of the Great Oolite.

A.—*Pterodactylus Kiddii*, Owen (Plate I, fig. 17).

The first phalanx of the wing-finger (fig. 17), referable to this species is somewhat stouter, but about one eighth shorter, than that bone in the *Pterodactylus suevicus*, Quensted,[1] from the Lithographic Slate of Wirtemberg. It indicates a species with a more powerful, though, perhaps, less elongate, wing. The groove for the flexor tendon of the fourth digit, bounded by the prominent thenal extensions of the two articular grooves, is well marked. The extensor process (ib., *c*) has a relatively longer basis than in the Kimmeridge specimens. A rough groove or linear depression beginning about an inch beyond the proximal articulation, and extending as far down the fore or thenal surface of the shaft of the bone, indicates the extensive attachment or insertion of that tendon. The shaft is subtriedral, the anconal side being the broadest; it becomes flattened towards the distal end, which expands unequally towards the ulnar side, and affords an oblong, moderately developed, concavo-convex surface for the second phalanx of the wing-finger.

This bone, from the Stonesfield Oolite, is slightly crushed.

B.—*Pterodactylus Duncani*, Owen (Plate I, fig. 18).

The first phalanx of the wing-finger, referred to the above species, is of the left wing, and is imbedded with the anconal surface exposed in a slab of Stonesfield Slate.

It is from a larger Pterodactyle than the preceding. The extensor process is thicker, but springs from a less extended base, relatively to the length of the bone.

C.—*Pterodactylus Aclandi*, Owen (Plate I, fig. 19).

This species is represented by a still larger specimen of the characteristic wing-bone (fig. 19) in Pterosauria. The olecranoid process (*c*) is shorter in proportion to the breadth

[1] "Ueber *Pterodactylus suevicus*," 4to, Tübingen, 1855.

and thickness of the proximal end, and the free termination of the process is more definitely marked by a smooth and shallow groove, over which it seems that the tendon of the "extensor alæ" may have glided before its insertion into the strong rough process (*e*).

The second phalanx of the wing-finger (Plate I, fig. 28) may have belonged to a Pterodactyle of the same species or size as the proximal phalanx of the *Pterodactylus Kiddii*. On this hypothesis its proportion of length would resemble that in the *Pterodactylus* (*Dimorphodon*) *macronyx* ('Monograph on the Fossil Reptilia of the Liassic Formations,' *Pterosauria*, Palæontological volume for year 1869, Plate XX). The distal end of the present "Stonesfield" bone becomes triedral by the rise of a ridge from the thenal aspect, extending longitudinally, and enlarging, to near the outer end of the distal oblong articular surface; this is more convex transversely than is the proximal surface. The longitudinal ridge in question afforded insertion to a strong flexor tendon.

§ 5. Pterosauria from the Lias.

I have not yet received any evidence of a Pterosaurian from the "Alum Shales" of Whitby, or any other member of the Upper Lias of our North-Eastern Coast, which represents, by the sum of its palæontological evidence, the "Posidonomyen-Schiefer" of Bavaria. There, however, in the locality of Banz, have been discovered instructive remains of a Pterosaurian, which Professor Quensted refers to my Lower-Liassic genus under the name of *Dimorphodon Banthensis*.

The specimen about to be described, from the Lower Lias of Lyme Regis, is insufficient to give subgeneric characters, and is provisionally registered under the wider generic name.

A.—*Pterodactylus Marderi*, Owen (Plate I, figs. 7, 8, 9).

Of this species is here figured the upper or proximal half of the right humerus (figs. 7 and 8). The head or articular surface (fig. 9) is a narrow, bent, or reniform convexity, with the concave margin toward the thenal side of the bone (fig. 7). The inner and more obtuse end of the articulation, with the tuberosity of that side, is broken away; the outer, narrower, and, in this species, pointed end is lost upon the ridge or upper border of the "pectoral process" (*b*). The expanded part of the shaft, beyond the articulation, is concave transversely on the thenal aspect (fig. 7), convex on the opposite or anconal side (fig. 8), which shows, as usual, no trace of the fossa and foramen characterising that part of the humerus in Birds of flight. The antero-posterior thickness

of this part of the bone is less than that of the contracted cylindrical part of the shaft lower down, the section of which is circular.

This humerus, besides being smaller than that of *Dimorphodon macronyx*,[1] has a more straight and slender shaft, which in transverse section is more nearly cylindrical.

B.—*Dimorphodon Macronyx*, Owen (Plate I, figs. 13, 14).

The other Pterosaurian fossil, obtained by Mr. Marder, from the same formation and locality, might well, by its superior size, and more ellipsoid section of the shaft, have formed part of the first long-bone of the wing of the species restored in the 'Monograph of Liassic Pterosauria' of 1870.

The articular surfaces of the humerus in both specimens of this Pterosaurian figured in that Monograph (Mon. cit., Plates XVII, XVIII, 53, 53[1]) were too much crushed and mutilated for profitable description. The present specimen shows instructively the distal articulation.

The surface for the radius presents one uniform convexity, *a*, oblong in shape, and obliquely disposed, extending from the lower part of the radial ridge (*c*), upward, forward, and ulnad; it is almost wholly developed from the thenal aspect (fig. 13), only the lower border of the convexity being visible from the anconal side (at *a*, fig. 14). It is longer and more prominent than the ulnar convexity or condyle. This (ib., *b*) is subhemispherical; its diameter equals the shorter diameter of the radial condyle. The intercondylar fissure is a mere cleft; and tuberous ridges, extending from the condyles, augment the breadth of the distal end of the humerus. The outer or radial one (*c*) is produced forward, bounding there, and in part forming the anterior concavity. The inner or ulnar ridge (*d*) is more distally placed, projecting to a lower level than the condyle (*b*); it is continued upwards with a convex curve, but is not produced forward like the radial ridge.

Both ridges are connected by a narrower one, extending transversely behind the two condyles, from which it is divided by a fossa (fig. *d*, *c*). There is a broad and shallow depression on the back part of the distal end of the humerus for a large "triceps" tendon: there is no anconal depression.

In my description of the articular end of a long-bone of a Pterosaur in the Supplement, No. 1, to the 'Monograph on Cretaceous Pterosauria" (1857), p. 16, Plate IV, figs. 1, 2, 3, I remarked that, "guided by considerations of size, the fragment might form the opposite end of the bone, indicated by the articular ends (Pl. II, figs. 7 and 8), which were referred to the head of the humerus. But I proceeded to remark, 'I am not acquainted with the precise configuration of the distal end of the humerus in any Pterodactyle. From general analogy, however, one should scarcely be prepared to find so

[1] 'Monograph of Liassic Pterosauria,' Pal. vol. for year 1869, pl. xviii, figs. 53, 53 *a*.

feeble an indication of divisions into condyles, an absence of a general convexity, and a presence of a well-defined concavity in one condyle, and as well defined a flattened or feebly concave facet in the other condyle, of the distal end of a humerus" (ib., p. 16). The demonstration of the true characters of this end of the humerus, given in Plate I, figs. 13, 14, and *d*, *c*, have justified the refusal to regard the articular end of the bone of the large Cretaceous Pterosaur as part of the humerus. Should it prove to be the head of a tibia, what a monstrous flying dragon it would indicate!

There is no part of the skeleton of the Bird that more resembles the answerable bone in a Pterosaur than the humerus. But the following, with other differences pointed out in the previous Monographs, are well marked and, as far as my observation goes, constant.

The pectoral process from the radial side of the proximal expansion of the humerus is relatively longer from base to apex, with a broader, more truncate, or less pointed termination in the flying Reptile: it usually forms a low angle in the Bird.

At the distal end of the humerus of the Bird the oblong radial condyle is usually more pointed anteriorly; the ulnar one is more extended transversely, and the intercondylar cleft is widened to a groove. The outer and inner ridges are not connected by a post-condylar transverse ridge. The olecranial surface is more depressed, and the tricipital tendinal grooves are better marked; but the transverse expansion of the distal end is less in proportion to the breadth of the shaft of the humerus in the Bird than in the Pterosaur.

Other differences in the Pterosaurian humerus, notwithstanding its adaptive development to flight, showing departure from the avian, and approach to the crocodilian, type are pointed out in detail in my Monograph (Palæontological volume for year 1858, issued in 1861, Supplement, No. III, 'Cretaceous Pterosauria,' p. 13, Plate III).

PLATE I.

Mesozoic Pterosauria.

Fig.

1. Left side view of fore end of upper jaw of *Coloborhynchus clavirostris.*
2. Front view of the same specimen.
3. Hind view of ditto.
4. Under or palatal view of ditto.
5. Left side view of fore end of lower jaw of *Pterodactylus Daviesii.*
6. Upper or oral view of the same specimen.
7. Front or thenal view of proximal portion of right humerus of *Pterodactylus Marderi.*
8. Back or anconal view of the same specimen.
9. Proximal end, with the 'head' or articular surface, of ditto.
10. Front or thenal view of proximal portion of left humerus of *Pterodactylus Manselii.*
11. Back or anconal view of the same specimen.
12. Proximal end, with the head or articular surface, of do.
13. Front or thenal view of distal end of right humerus of *Pterodactylus* (*Dimorphodon*) *macroynx.*
14. Back or anconal view of the same specimen.
15. Front or thenal view of distal portion of left humerus of *Pterodactylus Pleydellii.*
16. Back or anconal view of the same specimen. 16′. Articular end of ditto.
17. Front or thenal view of the proximal phalanx of the fourth or 'wing-finger' of *Pterodactylus Kiddii.*
18. Back or anconal view of the proximal phalanx of the 'wing-finger' of *Pterodactylus Duncani.*
19. Outer side view of the proximal phalanx of the 'wing-finger' of *Pterodactylus Aclandi.*
20. Outer side view of the proximal end of proximal phalanx of the 'wing-finger' of *Pterodactylus Manselii.*
21. Back or anconal view of the same specimen; 21*. articular surface of ditto.
22. Outer side view of proximal end of proximal phalanx of the 'wing-finger' of *Pterodactylus Pleydellii.*
23. Back or anconal view of the same specimen. 23′. Articular surface of ditto.
24. Articular surface of carpal bone of *Pterodactylus.*
25. Opposite articular surface of the same specimen.
26. Articular surface of homologous carpal bone of another kind of Pterodactyle.
27. Opposite articular surface of the same specimen.
28. Back or anconal view of second phalanx of 'wing-finger' of a Pterodactyle.

All the figures of the natural size.

The subject of figures 1—4, from the Hastings series of the Wealden, west of St.-Leonard's-on-Sea, Sussex, is in the possession of its discoverer, Samuel H. Beckles, Esq., F.R.S., &c. Those of the following figures are in the British Museum:—5 and 6 are from the Gault at Folkestone; 7, 8, 9, 13, 14, are from the Lias of Lyme Regis, Dorsetshire; 10, 11, 12, 15, 16, 20, 21, 21*, 22, 23, 23′, 24, 25, 26, 27, are from the Kimmeridge Clay, Dorsetshire; 17, 18, 19, 28, are from the Oolitic State, Stonesfield, Oxfordshire.

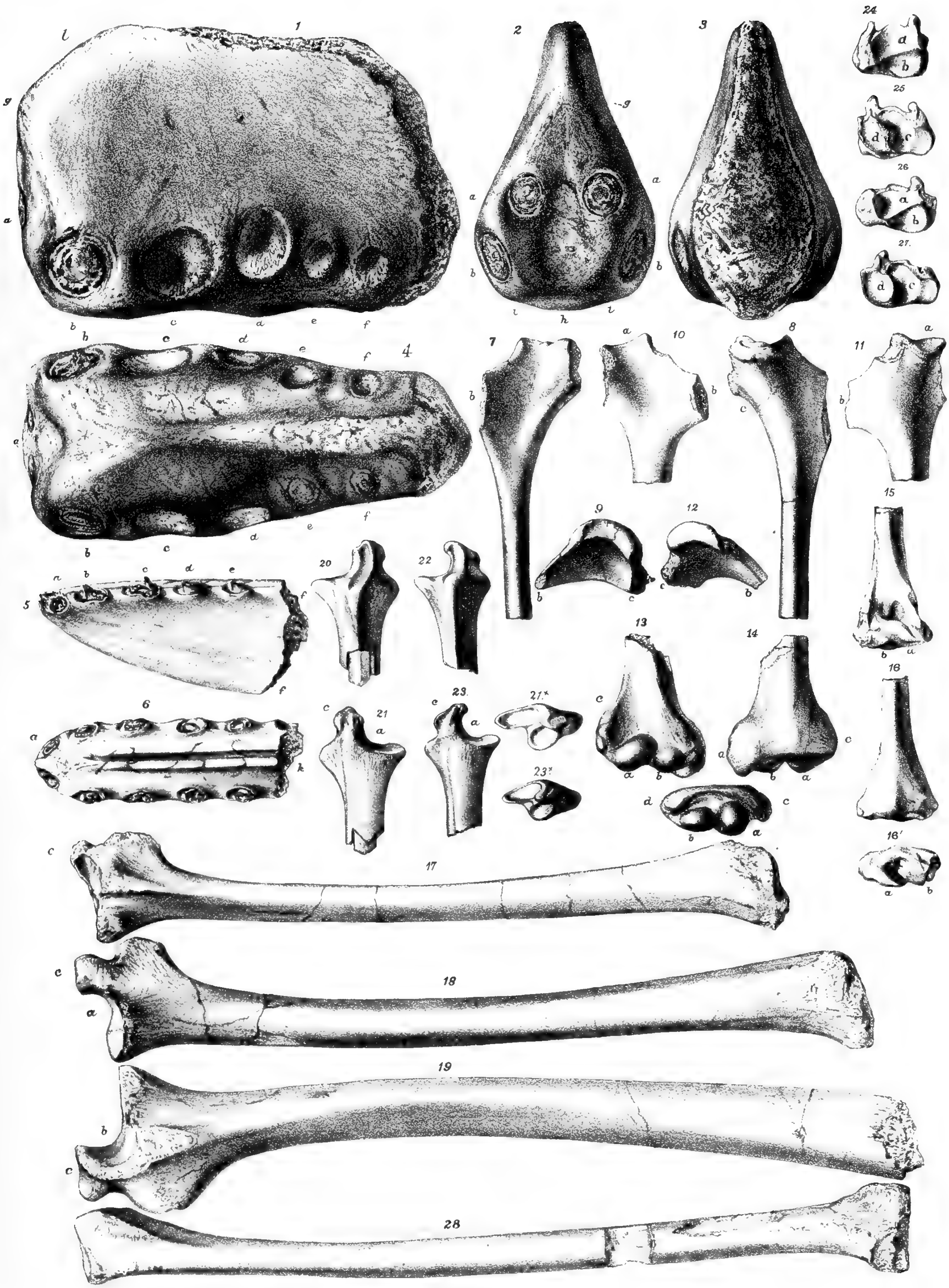

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PLATE II.

Mesozoic Pterosauria.

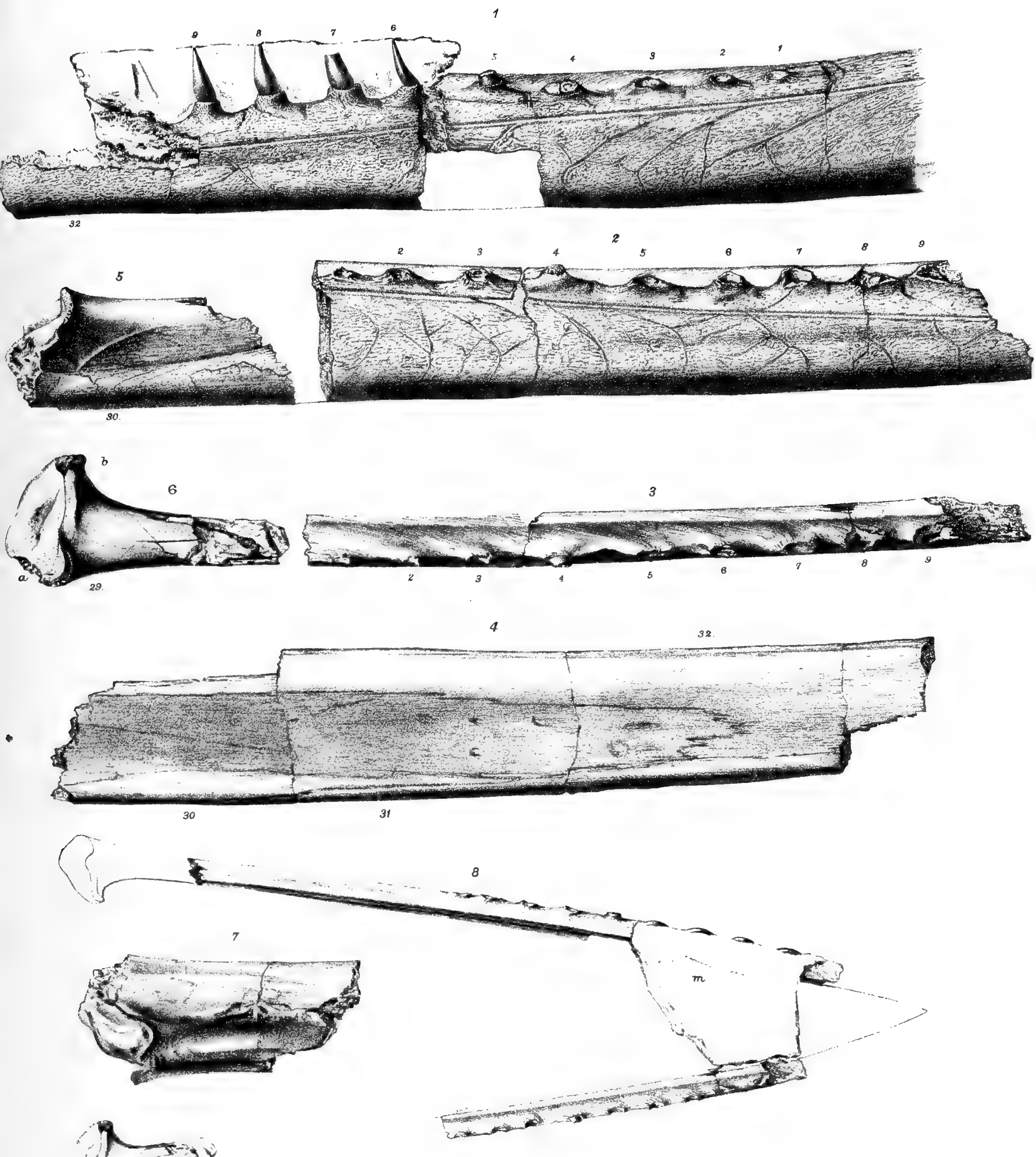
Fig.

1. Outer side view of part of left mandibular ramus, with teeth, of *Pterodactylus sagittirostris.*
2. Outer side view of part of right ramus of the same mandible.
3. Upper view of the same specimen.
4. Inner side view of part of the left mandibular ramus of ditto.
5. Outer side view of articular part of the right mandibular ramus of ditto.
6. Upper view of the same specimen.
7. Inner side view of the same specimen.

The above figures are of the natural size.

8. Reduced upper view of the same specimens, with conjectural restoration, in dotted outline, of the form or proportions of the entire mandible of *Pterodactylus sagittirostris.*

This fossil, from the Hastings series of the Wealden, west of St.-Leonard's-on-Sea, Sussex, is in possession of its discoverer, Samuel H. Beckles, Esq., F.R.S.



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